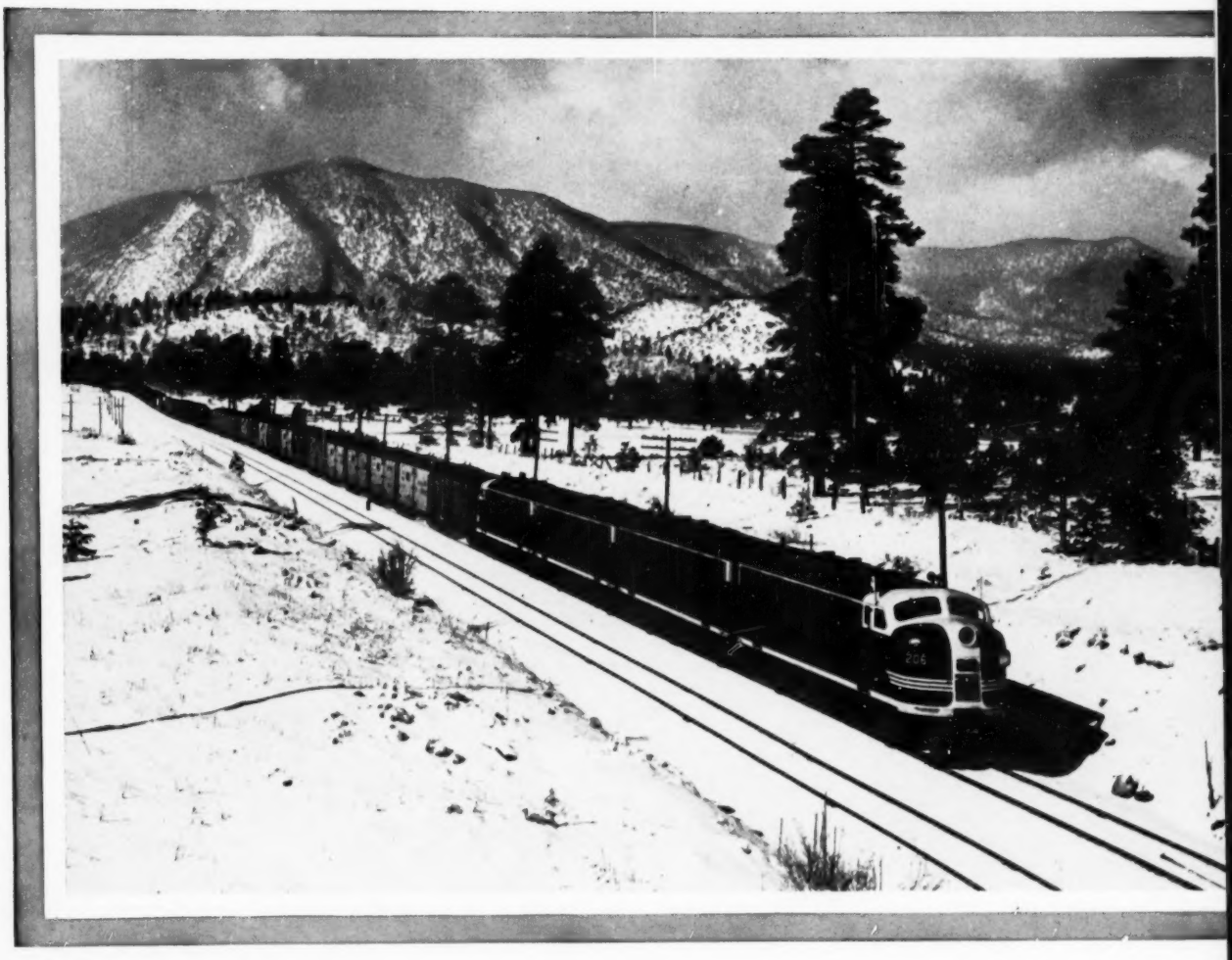
DIESEL POWER

AND DIESEL TRANSPORTATION

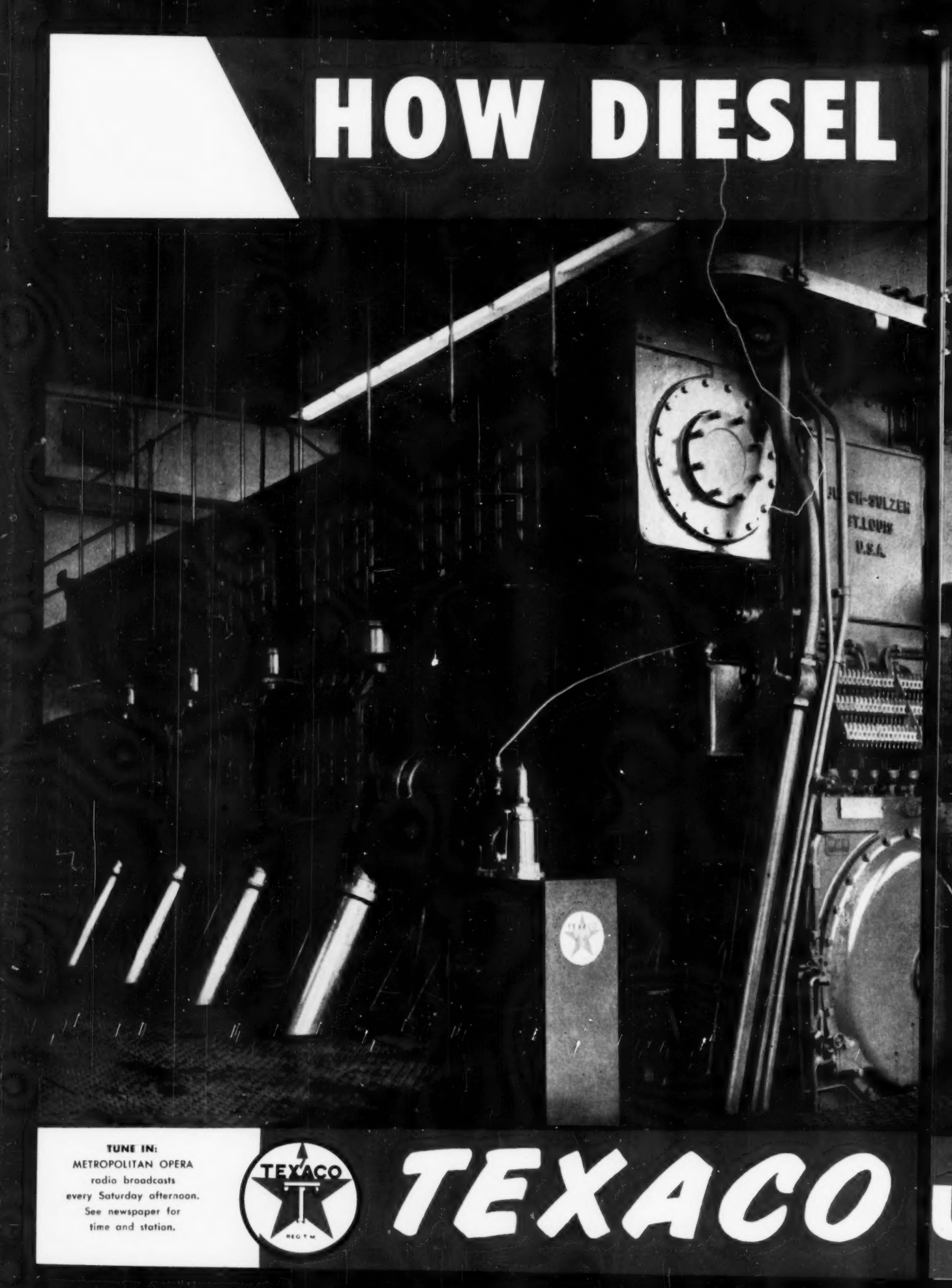
DECEMBER, 1953



Hamilton Engine — Freeport's Latest

Get The Most From Your Air Cleaners

HOW DIESEL



TUNE IN:
METROPOLITAN OPERA
radio broadcasts
every Saturday afternoon.
See newspaper for
time and station.

TEXACO
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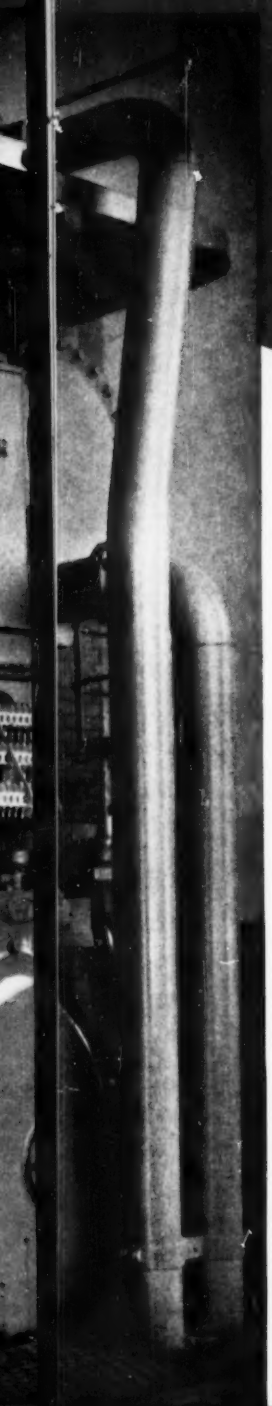
TEXACO

PLANTS CAN CUT FUEL CONSUMPTION



IMPORTANT among good maintenance practices is the use of a lubricating oil that is *exactly right* for your engines, whatever their type, size, speed, operating conditions, or fuel. This exactly-right oil is one of the famous *Texaco Ursa Oil* series — *a complete line* of lubricating oils for Diesel, gas and dual-fuel engines.

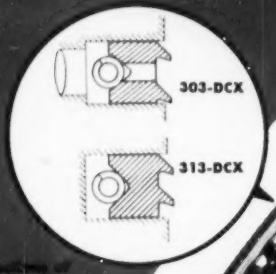
The *Texaco Ursa Oil* recommended for your engines will have outstanding resistance to oxidation and ability to assure clean operation. This means freedom from carbon, varnish and sludge . . . free rings for proper compression and combustion. Naturally, you'll get more power, use less fuel, reduce your maintenance costs.

The *Texaco Ursa Oil* series is approved by leading Diesel engine builders and is a favorite with operators everywhere.

Let a Texaco Lubrication Engineer help your plant set new records for efficiency and economy. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write The Texas Company, 135 East 42nd Street, New York 17, N. Y.

URSA OILS FOR ALL DIESEL, GAS AND DUAL-FUEL ENGINES

Why COOK "SUPER-FLEX" OIL CONTROL RINGS reduce lube-oil consumption



Sections of two typical rings.

Coil peripherial compression type expander, contained by the ring, simplifies application—fits existing grooves.

Straight-line oil flow, unrestricted by expander, assures maximum drainage.

Flexible ring section assures cylinder contact at all points—provides uniform and positive wiping action.

Tension is adjustable by inserting washers here.

Spring wire of rectangular cross-section gives expander stability—reduces localized stresses—assures uniform tension.

Ring and Expander Spring "float" in groove—cylinder contact is undisturbed by piston "slap".

Expander never touches groove lands or bottom—preventing damage to groove and expander.

COOK "SUPER-FLEX" OIL CONTROL RINGS

meet the crying demand for a more flexible ring that will conform to cylinder distortion and at the same time provide uniform wiping action all the way around the cylinder. Available in many styles to meet varying piston conditions, these advanced design oil rings reduce lube-oil consumption and maintain their efficacy throughout ring life. Write for recommendations job-engineered to your particular engine requirements. C. Lee Cook Mfg. Co., Incorporated, Louisville 3, Ky. Representatives in principal industrial cities.

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PISTON RINGS

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DIESEL POWER
AND DIESEL TRANSPORTATION

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C. W. Kinnear, *Special Railroad Representative*
John H. Wetherell Jr., *Associate Editor*
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December, 1953

Vol. 31, No. 12

Season's Greetings

Cover Photo: Gliding smoothly through the winter wonderland of northern Arizona is the Santa Fe Railway's Extra 206 East, pulled by a 4-unit General Motors diesel-electric locomotive.

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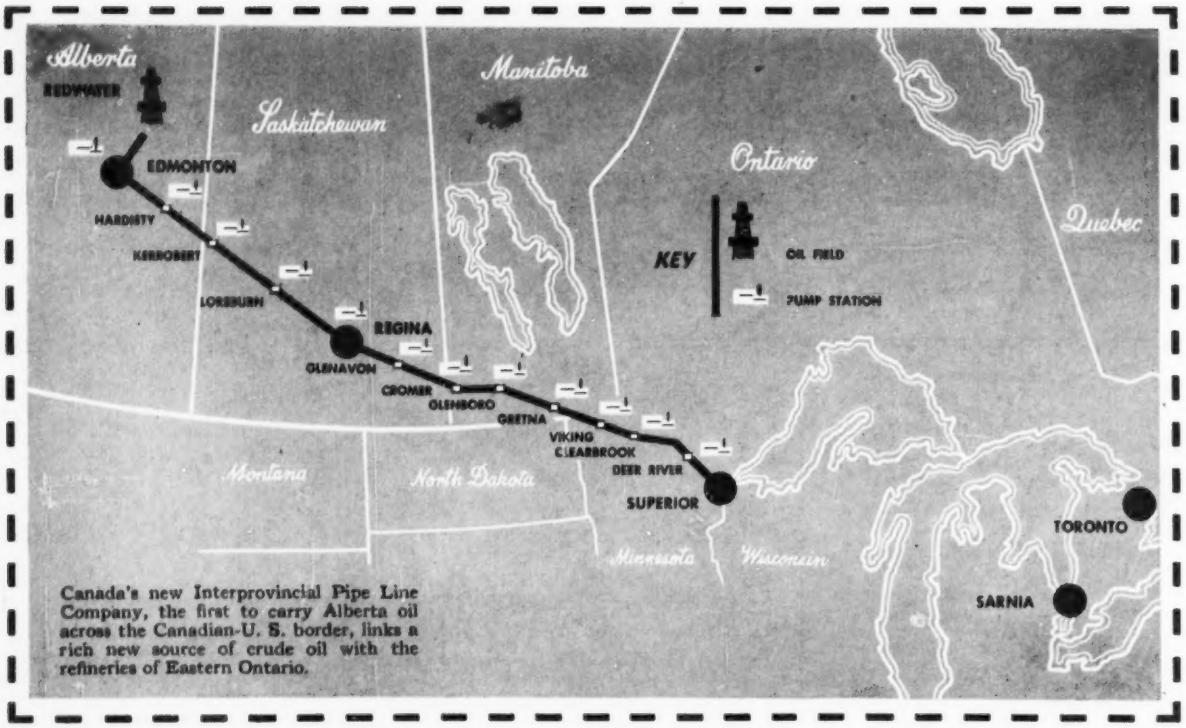


Canada's new Interprovincial Pipe Line Company, the first to carry Alberta oil across the Canadian-U. S. border, links a rich new source of crude oil with the refineries of Eastern Ontario.

Alco Diesel Engines Pump Alberta Oil 1137 miles to U.S. Port on Great Lakes

Canada's new 1137-mile Interprovincial Pipe Line and its American Subsidiary, Lakehead Pipe Line Company, Inc., offer an outstanding example of international teamwork—and open a new era in the history of Canadian petroleum.

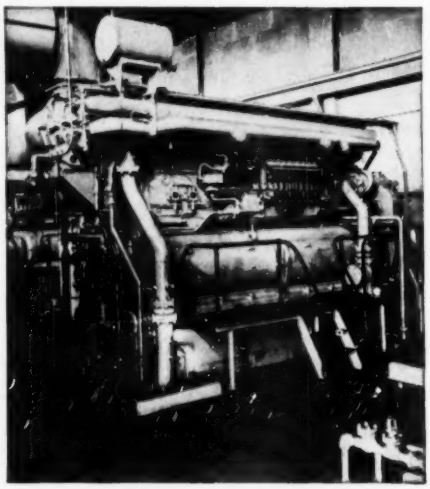
Served by Alco Diesel Engines, this first major Canadian pipeline (approximate annual capacity: 58.5 million barrels out of Edmonton) carries crude oil from the rich fields of central Alberta to the strategically located Great Lakes port of Superior, Wisconsin, from where it is transported to the refineries of Eastern Ontario.

Nine of the line's twelve pumping stations are located in Canada, three in the U. S. (see map). Each is powered by either two, three or four Alco Diesel Engines. Units for the Canadian stations were built under Alco license by the Dominion Engineering Works of Montreal; U. S. units were built in Alco's diesel plant at Auburn, N. Y.

Some of these 12½ in. x 13 in. engines have six cylinders and others, eight. Some are straight diesel and others are dual fuel. All of the engines are suitable for burning available crude oil.

The new Interprovincial Pipe Line is just one more major installation where the compactness, efficiency and flexibility of Alco Diesel Engines are helping to meet the free world's growing demand for petroleum products.

Your nearest Alco sales representative will be happy to give you detailed information on Alco Diesel Engines. Contact him at New York, Beaumont, Chicago, Cleveland, Houston, Kansas City, San Francisco, Schenectady or St. Louis.



Eight cylinder, 12½ in. x 13 in. Alco dual-fuel Diesel Engine, manufactured in Canada by Dominion Engineering Works, Montreal, shown in engine room of the Interprovincial's Edmonton, Alberta, pumping station.

ALCO DIESELS

AMERICAN LOCOMOTIVE COMPANY
SCHENECTADY, N. Y.

Alco

The mark of modern engineering

Here's News on New Profits!

- NEW Profits are yours when you own the NEW Van Norman No. 465. For No. 465 . . . with a capacity of *60"* x *18"* . . . is simplicity itself to operate. And it includes these features:
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- NEW Multiple-Disc Clutch . . . only requires *one* movement of *one* lever to engage work while motor is running.

NEW!

No. 465

- NEW Unit-type Spindle . . . preloaded, prelubricated.
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- NEW No. 465 Carries NEW LOW PRICE for HIGH VAN NORMAN QUALITY!

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...with TYCOL lubricants on hand!

It pays to buy a "Diesel-Designed" Lubricant! ... It takes "something more than a motor oil" to counteract excessive wear in Diesel engines – and we proved it with Tycol Adeltran 40! In this instance, a Diesel engine was operated for one year with a competitive oil. An overhaul by the manufacturer turned up these conditions: all liners had to be replaced as well as piston rings ... 2 top compression rings were stuck and all rings were gummed up. After the switch to Adeltran (for the same operating period) liner wear was negligible ... filter life was considerably extended ... all rings were free and in excellent condition ... and owner reported an exceptionally clean engine base. For full details on Adeltran, contact your local Tide Water Associated office!

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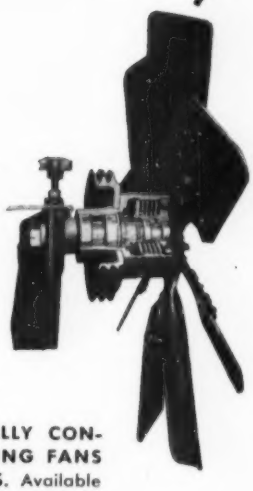
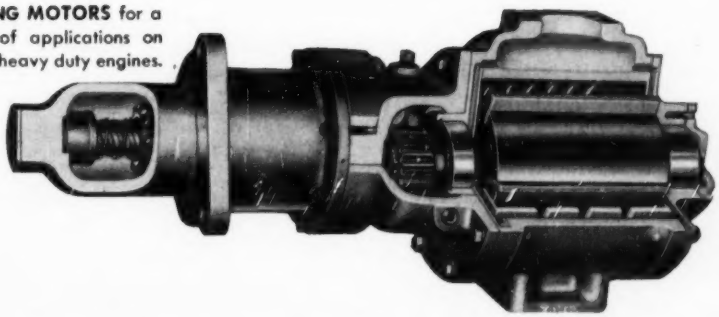
All of our products for your Diesel engines are engineered for your particular application and requirements. More than one-third of a century of research, intensive engineering, broad field experience with unexcelled manufacturing facilities are back of our products. We gladly offer our engineering assistance and our extensive facilities to produce and serve you efficiently.



THERMOSTATICALLY CONTROLLED COOLING FANS AND FAN DRIVES. Available for installation by owner on many makes and sizes of heavy duty engines.

POSITIVE DISPLACEMENT SUPERCHARGERS for engine sizes from 50 to 500 HP and pressure ratios of 2:1 max.

AIR STARTING MOTORS for a wide range of applications on many sizes of heavy duty engines.



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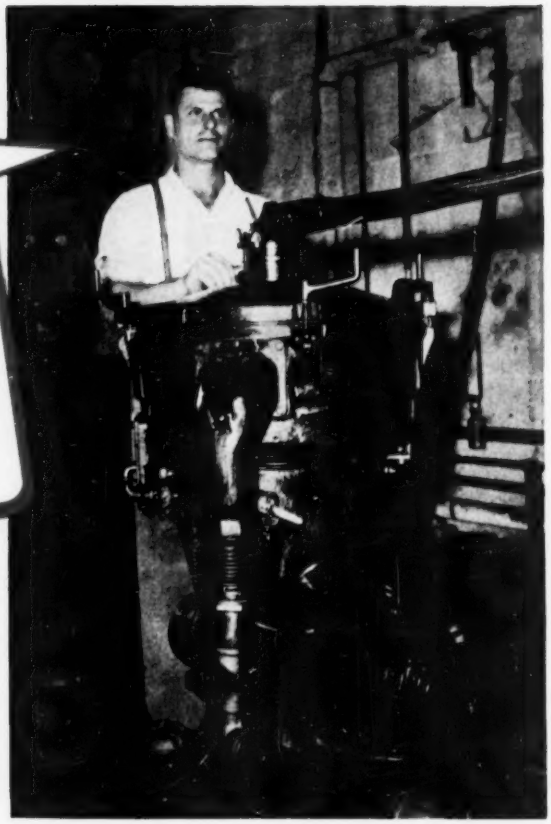


***Robert Dodd, Chief Engineer**
Clay Electric Co-op

"At our Keystone Heights, Florida, plant we have been burning residual fuels in our diesel engines for well over two years. We use a straight residual fuel and enjoy the full differential between its cost and No. 2 fuel. All fuel is centrifuged in a De Laval Heavy Fuel Oil Purifier. This centrifuge removed dirt from the heavy fuel at the rate of 13 to 15 pounds per 5 hours of operation.

"As a result of burning this De Laval centrifuged heavy fuel, we saved up to $4500 per month . . ."

De Laval Heavy Fuel Oil Purifiers are ideally suited to preparing heavy fuel for burning. They are designed so that purification takes place at a constant rate; there is no reduction in separating efficiency until the entire dirt holding space is full of solid material. This one feature alone makes it the outstanding means of cleaning up residual oil and enjoying the profits that such operation can bring.

DE LAVAL

THE DE LAVAL SEPARATOR COMPANY
Chicago POUGHKEEPSIE, N.Y. San Francisco

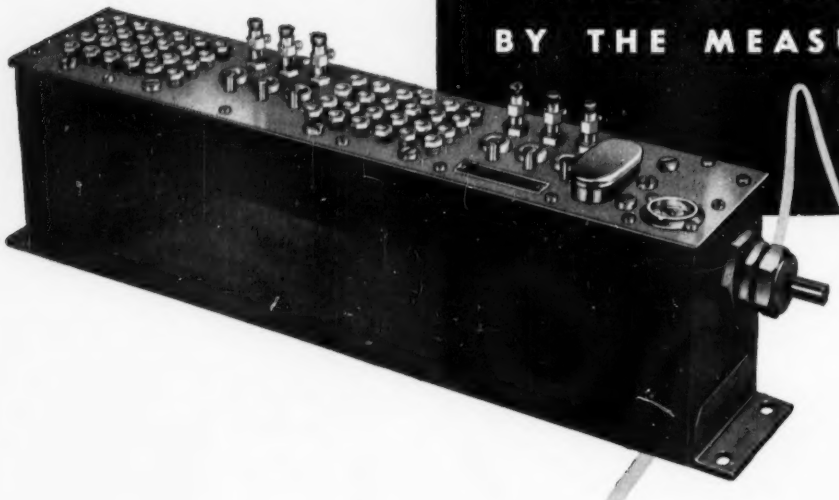
HEAVY FUEL OIL PURIFIERS

greatest name in diesel fuel injection...

AMERICAN
BOSCH

Look to American Bosch
for continued leadership
in diesel fuel injection.

MADISON-KIPP
Fresh Oil
. . . FED UNDER PRESSURE BY THE MEASURED DROP



the most dependable method of lubrication ever developed!

This lubricator becomes an integral part of a machine tool in which there are 48 vital bearings that require dependable lubrication. The Madison-Kipp mechanism is so compact that the reservoir measurements are only 4" wide, 19¾" long by 5¾ high."

There are six different models to meet almost every application requirement. Please write us for all details regarding your particular lubricator requirements.

MADISON-KIPP CORPORATION
205 WAUBESA STREET • MADISON 10, WISCONSIN

kipp

• Skilled in Die Casting Mechanics • Experienced in Lubrication Engineering • Originators of Really High Speed Air Tools

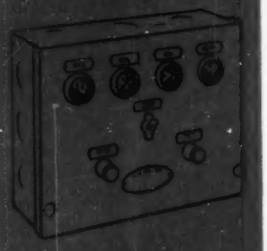
Automatic ENGINE CONTROLS

CRANKING CONTROLS

OIL & WATER SWITCHES

ALARM RELAYS

You can get a SYNCHRO-START Control to meet any Engine Control requirement, for Gas, Gasoline or Diesel engines, no matter what the power application may be, either for FULL AUTOMATIC, SEMI-AUTOMATIC, MANUAL, PROTECTION ONLY, or a COMBINATION of any or all of the control features to meet exactly what you want, or that is needed to fulfill a specific demand.

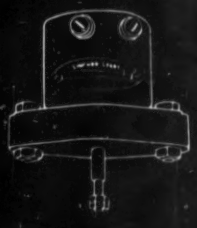


SAFETY ALARM SETS

FC AUTOMATIC CONTROL SETS

Nineteen years of manufacturing engine controls, ranging from a simple switch to multiple-engine control panels, have given SYNCHRO-START the "know-how" to make thoroughly DEPENDABLE CONTROLS to meet your needs correctly.

OVERSPEED GOVERNORS



SOLENOIDS

When you order your engines—SPECIFY SYNCHRO-START Controls. Your manufacturer, dealer, engineering firm, or architect can furnish you with the correct control. Or write us direct for our nearest representative.

FIRE PUMP PANELS

FULL AUTOMATIC CONTROL SETS

SYNCHRO-START PRODUCTS, INC.

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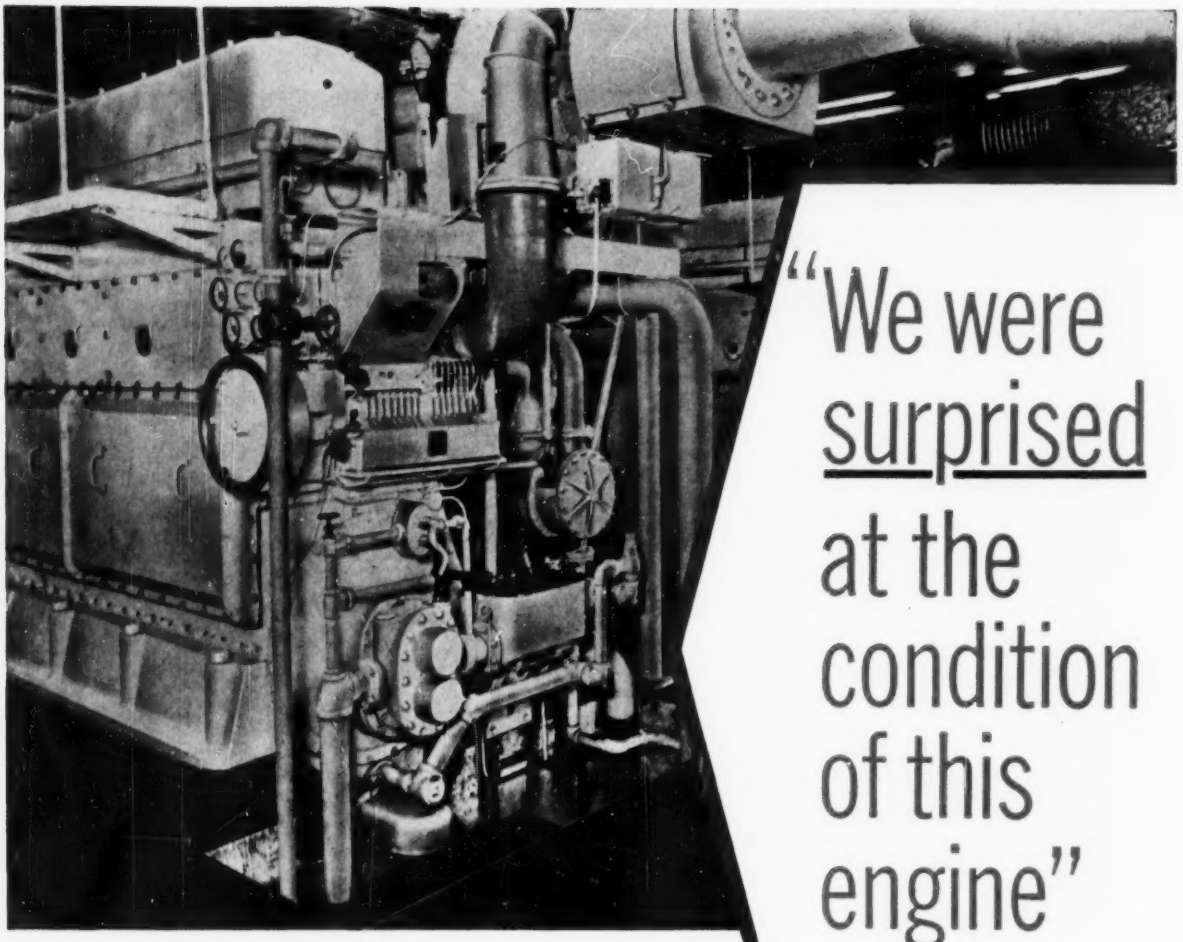


"We were surprised at the condition of this engine"

... says G. V. Yarger,
Supt. Municipal Utilities
Waverly, Iowa

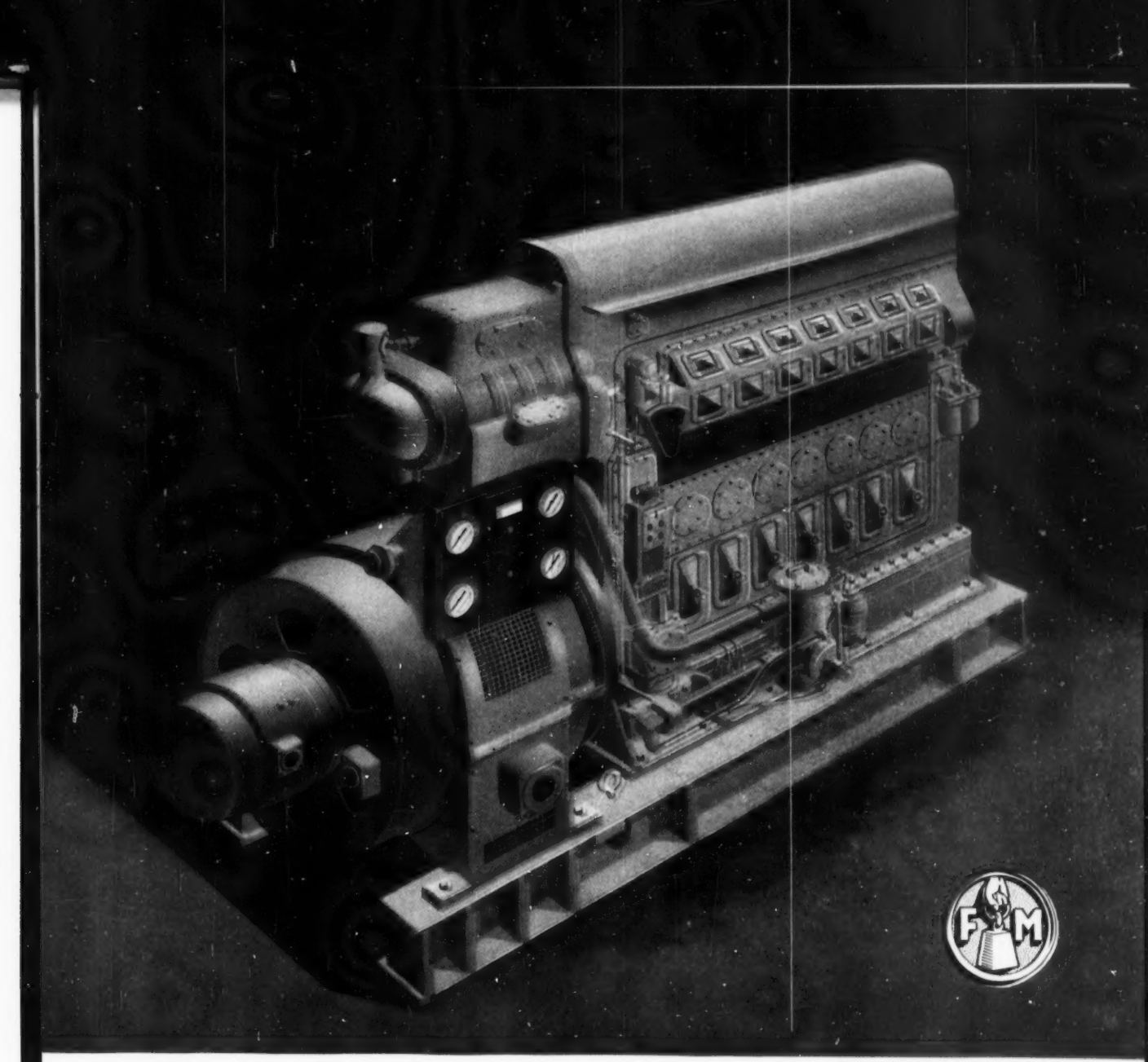
"When we finally opened up our Worthington, it was in the *best* condition I've ever seen a diesel engine that had operated such long hours and under such heavy loads as this unit. It had a total of 48,926 hours on it – 8,987 hours of tough operation since the last overhaul.

Mr. Yarger continues, "We've been using Sinclair RUBILENE® Heavy in the crankcase and RUBILENE H.D. 30 in the cylinder lubricator. These RUBILENES have kept the crankcase and upper portions of the cylinders exceptionally clean and bright, with no sign of carbon or deposits."

That's a typical report on the exceptional qualities of the Sinclair RUBILENES . . . evidence that they could improve the efficiency of *your* diesels, too. Why not switch now? Contact your nearest Sinclair Representative or write Sinclair Refining Company, 600 Fifth Avenue, New York 20, N. Y.

SINCLAIR DIESEL OILS

save wear and replacements



The Fairbanks-Morse Opposed Piston Diesel Model 38F 5¼. 225 to 750 horsepower. Diesel, Dual Fuel and Spark-ignition options. Other O-P engines available in horsepower ratings to 2400.

Some engines are not good enough

Yes, there are some diesels which just do not have what it takes for the job. They cannot satisfy the owner's pride in smooth, trouble-free operation and are lacking in the ability to square a balance sheet of operational costs and profits. For the more difficult jobs, many engines are simply not good enough.

Maybe you should pay more and get more!

If you want more engine-hours with fewer man-hours, *then* you should have the F-M Opposed Piston Diesel which will cost a little more and give you much, *much* more.

Fairbanks, Morse & Co., Chicago 5, Illinois.

FAIRBANKS-MORSE

a name worth remembering when you want the best

DIESEL AND DUAL FUEL ENGINES • DIESEL LOCOMOTIVES • RAIL CARS • ELECTRICAL MACHINERY • PUMPS • SCALES • HOME WATER SERVICE EQUIPMENT • FARM MACHINERY • MAGNETOS

Smooth Starts

mean low operating costs

WHEN a rear-dump truck pulls away smoothly from a shovel with a 30-ton pay load – without jolts and jerks – it's sure to stay on the job longer with less down time.

Trucks equipped with Allison TORQMATIC converters and transmissions always start smoothly – because TORQMATIC DRIVES absorb these shocks instead of transmitting them to other truck parts.

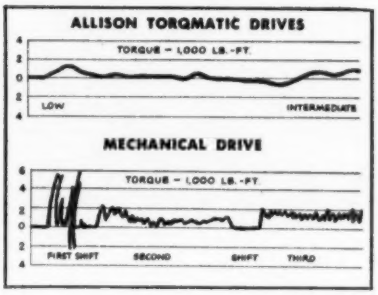
To demonstrate this, Allison engineers measured power-train shock loads in a large number of earth-moving, coal and ore-hauling trucks under both normal and extreme operating conditions. These charts show the results.

Trucks equipped with Allison TORQMATIC DRIVES showed starting shock loads four times less severe than trucks using mechanical drives. Furthermore, trucks equipped with Allison TORQMATIC DRIVES were *quick-shifted* at full throttle.

If you're operating off-highway trucks or other heavy-duty earth-moving equipment, specify Allison TORQMATIC DRIVES, the matched team of torque converter and hydraulic transmission. Ask your dealer, equipment or engine manufacturer for further information or write to:

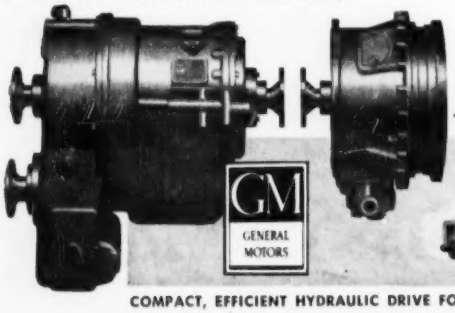
ALLISON *Division of* GENERAL MOTORS
Box 894SS, Indianapolis 6, Indiana

POWER-TRAIN SHOCK LOADS

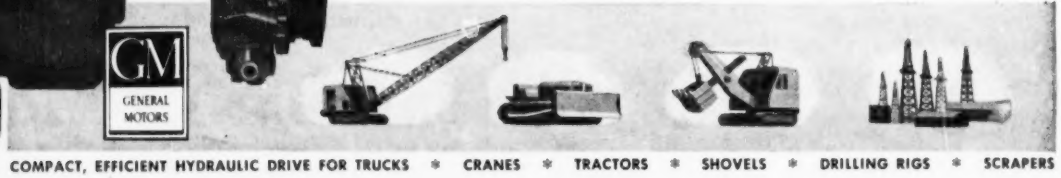


Note the jagged line – shock loads – as the mechanical drive truck pulls away from the shovel and shifts from first to second gear. Compare the smooth line – no harmful shock loads – for the truck equipped with Allison TORQMATIC DRIVES.

MATCHED UNITS BUILT BY ONE MANUFACTURER



Allison TORQMATIC DRIVES



COMPACT, EFFICIENT HYDRAULIC DRIVE FOR TRUCKS * CRANES * TRACTORS * SHOVELS * DRILLING RIGS * SCRAPERS

THE ENGINEER'S REPORT

DATA

PRODUCT Chevron Starting Fluid

UNITS Passenger Buses

CONDITIONS Early morning starts — Freezing temperatures

APPLICATION Spray into blower intakes

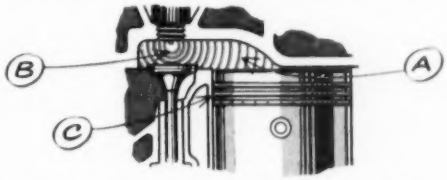
FIRM Salt Lake City Lines, Inc., Salt Lake City, Utah

Late starts eliminated on 130-bus fleet!

IN 8 YEARS USING CHEVRON STARTING FLUID, Salt Lake City Lines has never had one of their 130 diesel buses leave behind schedule, even on coldest mornings. Before using Chevron Starting Fluid, several buses were late every winter morning. They needed booster batteries and at least one extra full-time man to start engines ½ to 1 hour early; engines then idled until departure. Savings in man-hours and batteries, plus end of fuel waste and engine wear due to idling, cut total operating and maintenance costs at least 2%, according to Mr. William Wilson, Superintendent of Maintenance. He says, "We wouldn't be without Chevron Starting Fluid...we couldn't operate with the staff we have."

ONE SHORT SPRAY of fluid into spring cup on blower intake permits immediate starts. Chevron Starting Fluid is available in 1-pint cans and 7- and 17-cc gelatin capsules.

How CHEVRON Starting Fluid starts Gasoline and Diesel Engines instantly



A. Atomizes in lowest temperatures and provides powerful, easily ignited vapor in combustion chamber.

B. Pressure, or the weakest spark, fires mixture—turns engine and heats air for regular fuel mixture.

C. Contains lubricant and additives—inhibits cylinder wear and ice formation in primer equipment.

HOT NEWS for COLD ENGINES

FREE FOLDER gives you more facts on Chevron Starting Fluid—shows where it should be applied in different type engines. Write or ask for it today.

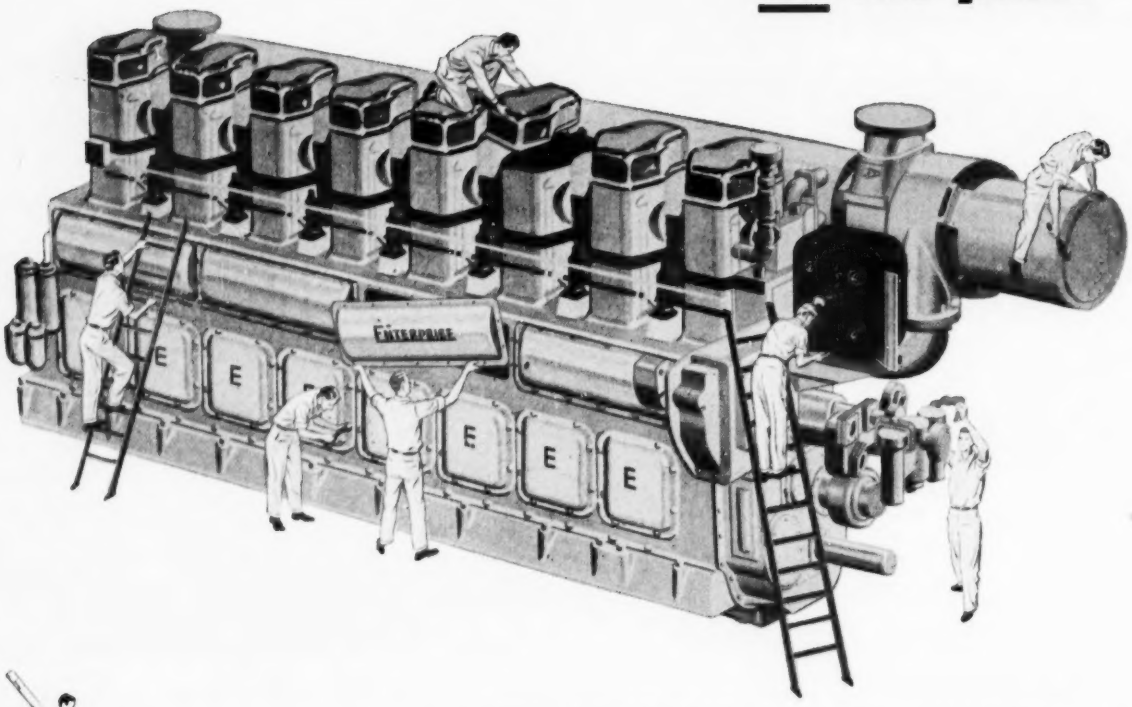
CHEVRON STARTING FLUID

TRADEMARK REG. U.S. PAT. OFF.

FOR MORE INFORMATION about this or other petroleum products of any kind, or the name of your nearest distributor handling them, write or call any of the companies listed below.

STANDARD OIL COMPANY OF CALIFORNIA, San Francisco 20 • STANDARD OIL COMPANY OF TEXAS, El Paso
THE CALIFORNIA OIL COMPANY, Barber, New Jersey • THE CALIFORNIA COMPANY, Denver 1, Colorado

It's easy to get to all the parts



Check these points
on "Easy-Access" ENTERPRISE Design
All major moving parts are enclosed with removable covers:
Main and connecting rod bearings are fully accessible through large door plates on both sides.
Cams, followers, camshafts and bearings are easily reached and removed.
Cylinder head and rocker arm assemblies, push rods and fuel nozzles are easy to reach by removing oil and dust-proof covers.
Gears are accessible through easily removable inspection covers.
No bulky shrouds or surplus covers to remove before getting to engine.
Parts, accessories and controls requiring occasional inspection or servicing are externally mounted.

You'll find that ENTERPRISE accessibility saves time, money and manpower in maintenance and overhaul

Ever watch precious hours slip by trying to find a way to dismantle, inspect or replace an engine part or assembly? Such unnecessary and costly down-time is something you don't have to worry about with modern, "easy-access" ENTERPRISE Diesels. For ENTERPRISE service-wise engineers have designed every model in the entire 73 to 2284 HP line for maximum accessibility and easy, low-cost servicing. That's why we say – and mean – you'll have less down-time if it's powered by an ENTERPRISE Dependable Diesel!

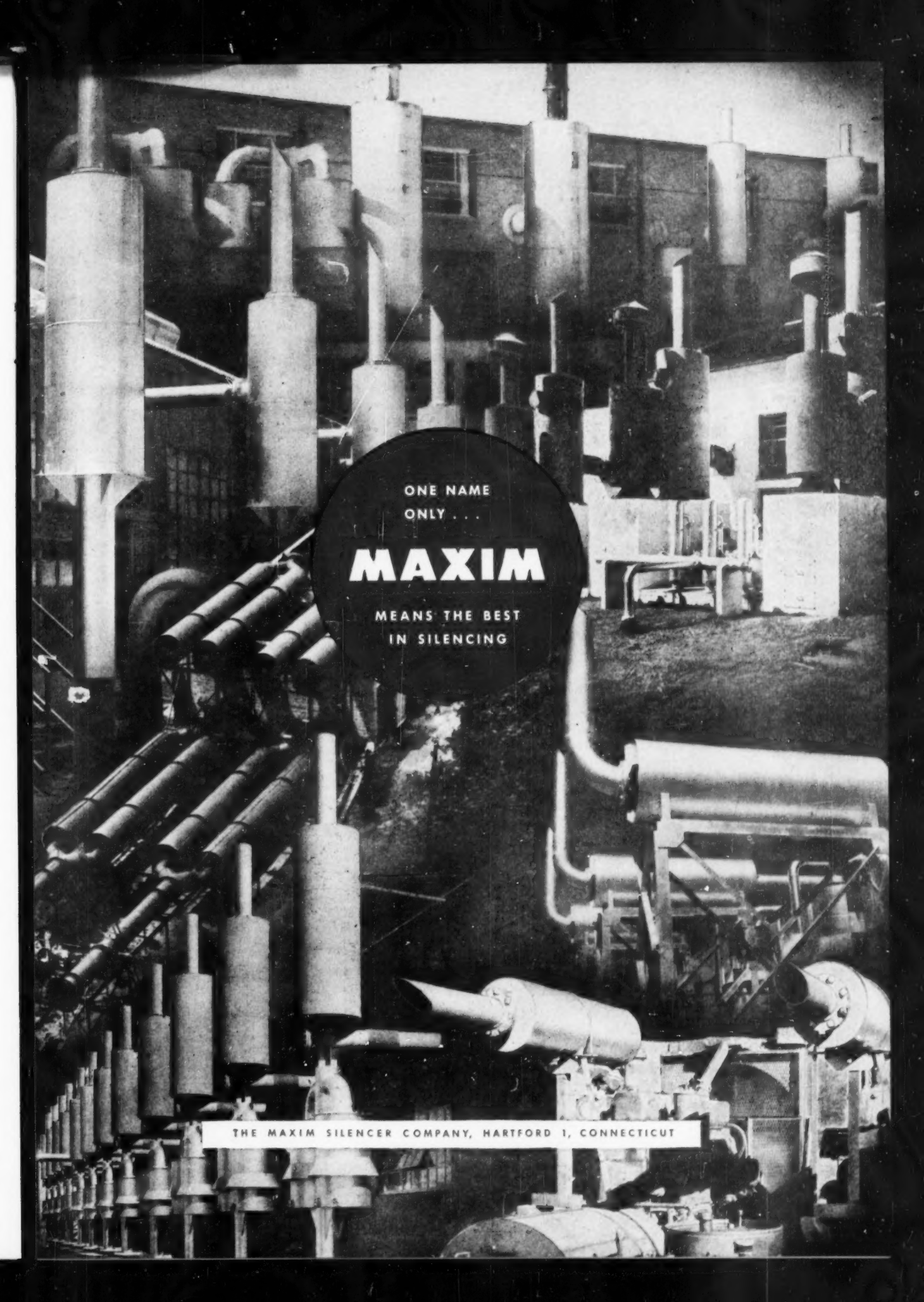
Write for descriptive bulletins, or call your nearest ENTERPRISE *Diesel sales office.*

Enterprise
DEPENDABLE
Diesels

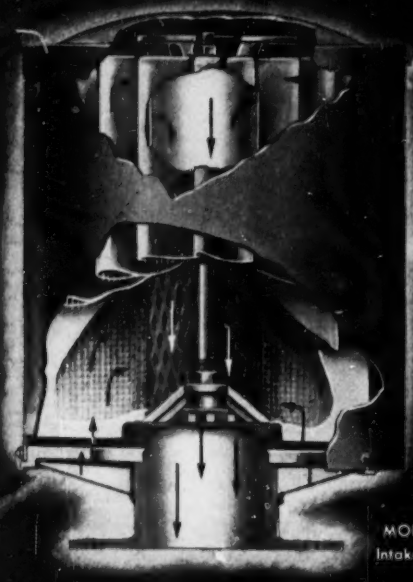
18th & Flordia Streets, San Francisco 10, California

Boston · Chicago · Denver · Kansas City · Los Angeles
Minneapolis · New Orleans · New York · San Diego
San Francisco · Seattle · St. Louis · Washington, D. C.

DIESEL ENGINES • OIL BURNERS • PROCESS MACHINERY


ONE NAME
ONLY . . .
MAXIM
MEANS THE BEST
IN SILENCING
THE MAXIM SILENCER COMPANY, HARTFORD 1, CONNECTICUT

YOUR EQUIPMENT WILL LAST LONGER with STAYNEW INTAKE FILTERS!



MODEL D
Intake Filter

AND HERE'S WHY! Your equipment needs the protection Staynew Intake Filters are designed to give. Staynew Intake Filters stop the dust and dirt from entering through air intakes. Staynew's *Positive Protection* keeps shutdowns and repairs at an absolute minimum, actually lengthening equipment life. And Staynew itself requires less attention than ordinary intake filters, frequently operating two or more years *without maintenance.*

Write today for catalog S. I. F.

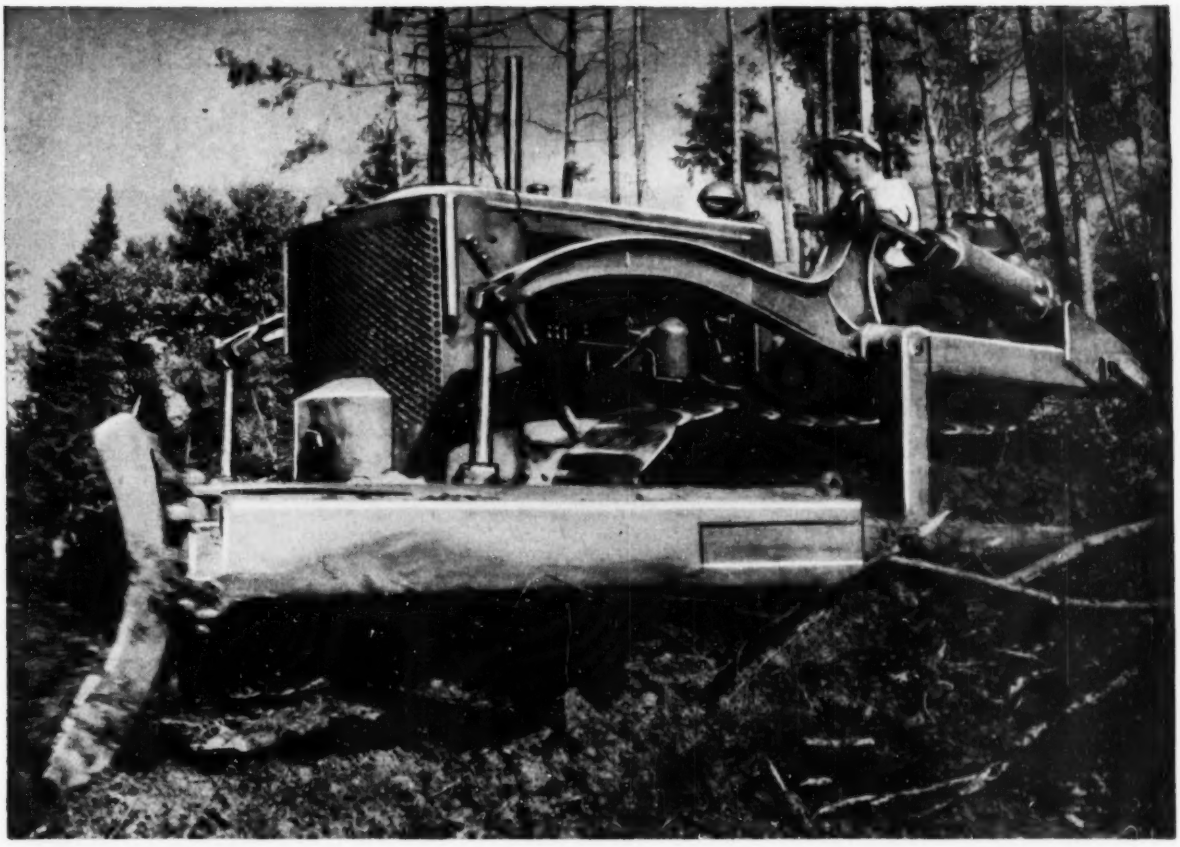
DOLLINGER PROTECTION FOR STAYNEW FILTERS

Representatives in Principal Cities

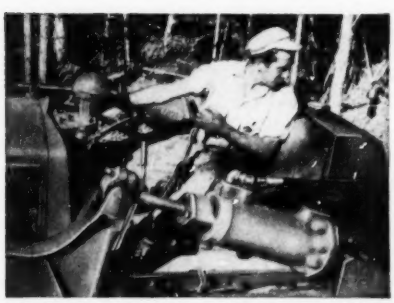
DOLLINGER CORPORATION

10 Centre Pk., Rochester 3, N. Y.

ALL TYPES OF FILTERS FOR EVERY INDUSTRIAL NEED



BESIDES CUTTING OUT ROADS, Riendeau uses his TD 14 to push his truck and a 15-ton load through quagmire road sections.



RIENDEAU HANDLES BULLDOZER HIMSELF. He says: "I've had first-hand experience with the terrific performance these highest quality Cities Service Products deliver."

New Hampshire Logger Cuts Truck Roads Through Forest!

Oscar Riendeau of Berlin, N. H., has been hauling logs for about 15 years. To get his lumber out of densely overgrown New England forests, Riendeau has to cut his own truck roads. He carves out his twisting, turning truck roads with an International TD 14 Diesel . . . powered by Cities Service #2 Diesel Fuel! . . . lubricated with Cities Service Lubricants!

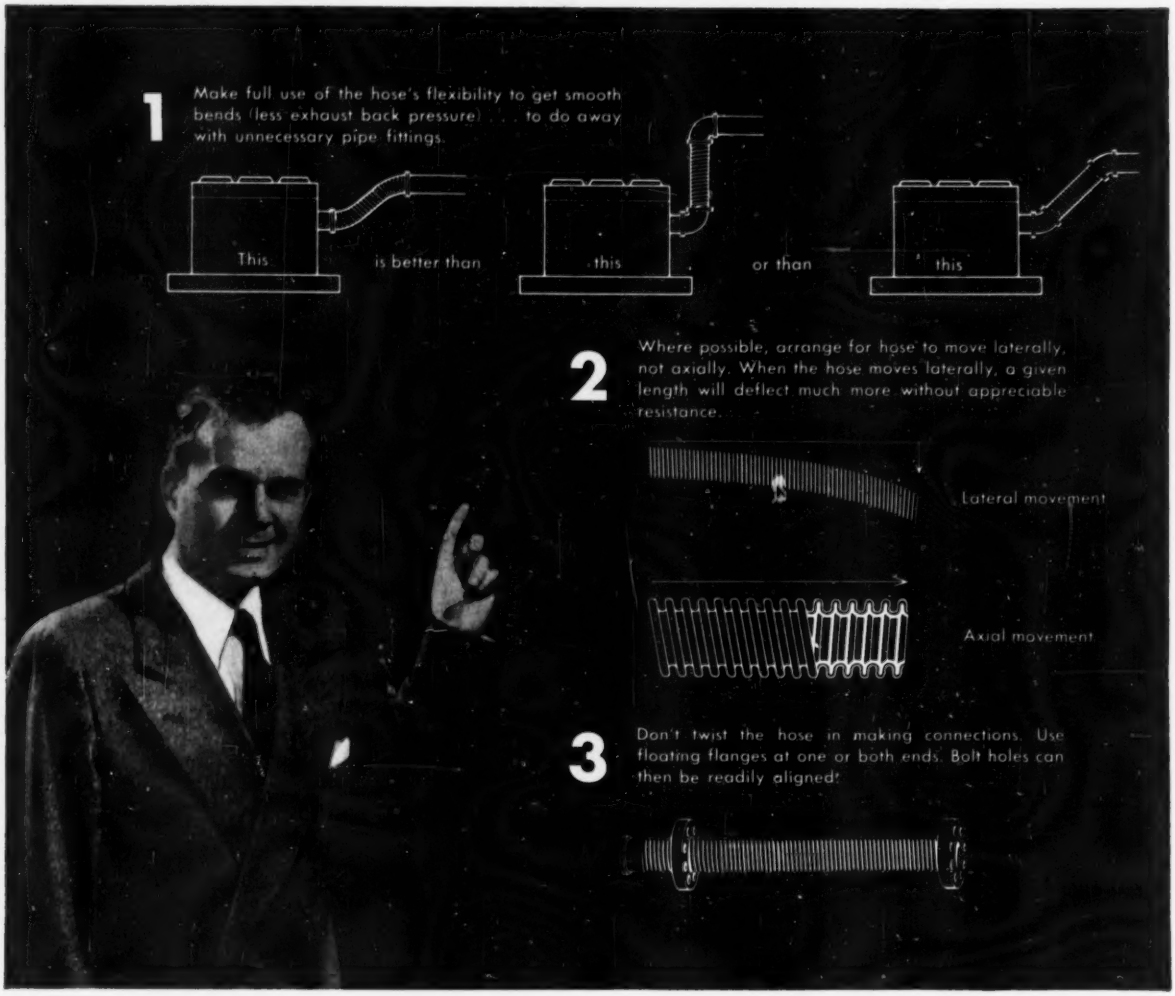
Says Riendeau: "I use Cities Service Products throughout my operation . . . diesel fuels, lubricants, gasolene, and even tires. These high quality, dependable products have kept my equipment at work full time under really rugged conditions. I heartily recommend them for any earth moving or trucking operation."

Why not try Cities Service Fuels and Lubricants in your operation?

CITIES SERVICE

QUALITY PETROLEUM PRODUCTS

3 tips on how to install American Flexible Steel Hose in diesel exhaust systems


1
Make full use of the hose's flexibility to get smooth bends (less exhaust back pressure) . . . to do away with unnecessary pipe fittings.
This
is better than
this
or than
this
2
Where possible, arrange for hose to move laterally, not axially. When the hose moves laterally, a given length will deflect much more without appreciable resistance.
Lateral movement
Axial movement
3
Don't twist the hose in making connections. Use floating flanges at one or both ends. Bolt holes can then be readily aligned.

No exhaust system for a diesel engine is *complete* without flexible exhaust hose. Countless actual installations have proven that *American Flexible Steel Exhaust Hose* can "take it" in the day-in day-out grind of carrying hot exhaust gases . . . safely and reliably at low cost.

American Flexible Steel Exhaust Hose absorbs vibration and reduces its transmission...allows for expansion or contraction caused by temperature changes in the exhaust lines. There's less chance of overstressing bolts or distorting engine parts.

This hose bends into desired position easily. Its flexibility also simplifies installation when considerable offset is required. Once it's installed, you're sure of years of trouble-free service.

American Flexible Metal Hose for exhaust and air intake—marine or industrial diesels—is available in corrugated steel, 2 in. to 16 in. I.D. inclusive. For full details, write for Bulletin EH-50-1. *The American Brass Company, American Metal Hose Branch, Waterbury 20, Conn. In Canada: The Canadian Fairbanks-Morse Co., Ltd.*

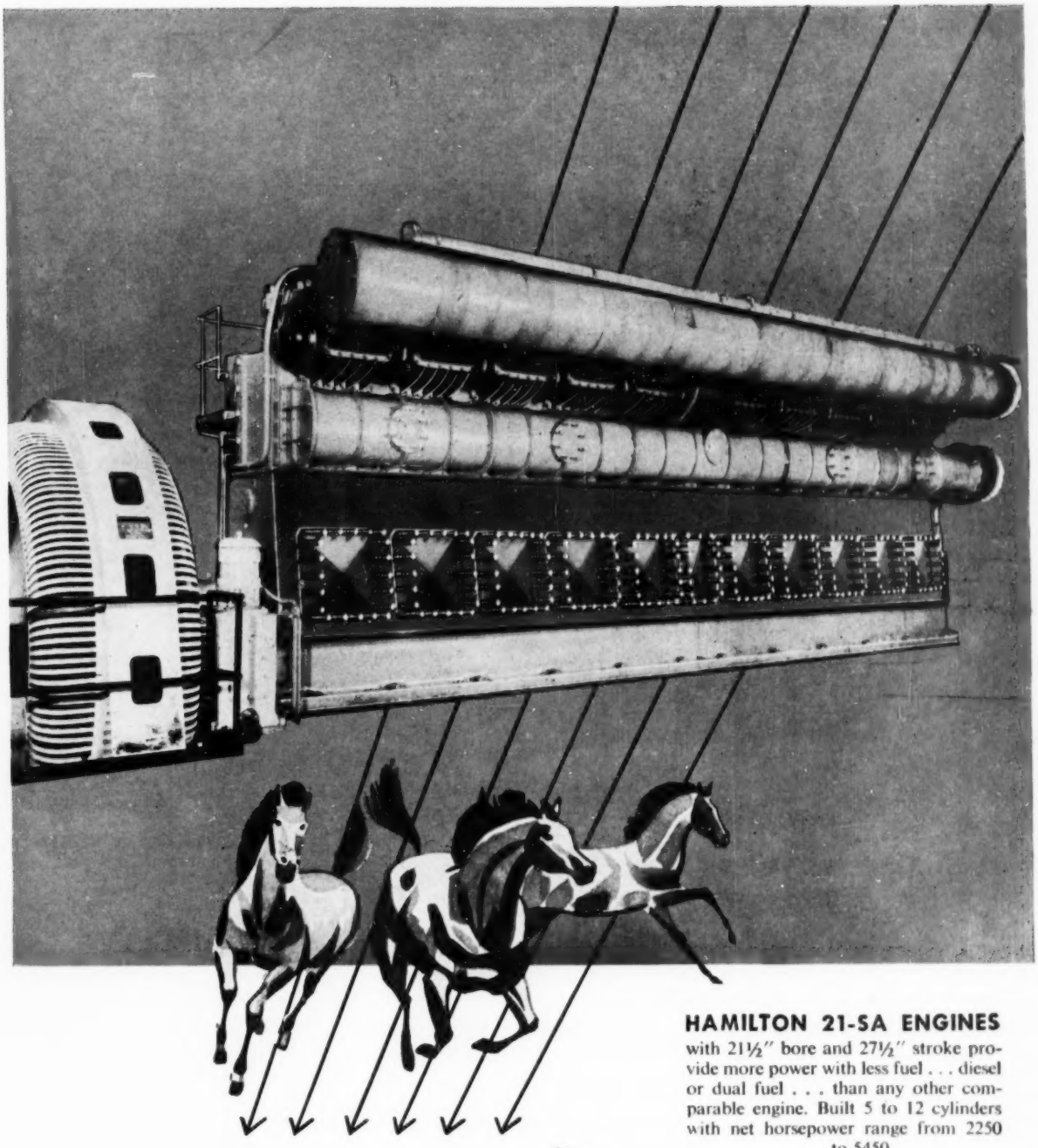
OTHER PRODUCTS FOR DIESEL USE – Flexible tubing with wire braid covering for: starting air, circulating water, fuel oil, lubricating oil. Tubing available in bronze, carbon steel and stainless steel. Assemblies complete with fittings.

WHEREVER CONNECTORS MUST MOVE

AMERICAN

flexible metal hose and tubing

an **ANACONDA®** product



HAMILTON 21-SA ENGINES
with 21½" bore and 27½" stroke provide more power with less fuel . . . diesel or dual fuel . . . than any other comparable engine. Built 5 to 12 cylinders with net horsepower range from 2250 to 5450.

HAMILTON DIESELS

give more horsepower per cylinder size and engine speed on either dual fuel or the heaviest Bunker C

Write! This booklet describes fully Hamilton's new design . . . including revolutionary combustion and scavenging system.

HAMILTON DIVISION, HAMILTON, OHIO

BALDWIN • LIMA • HAMILTON

This iron horse is taking $17,127 a year out of somebody's pocket!

LAST year there were 14,013 steam locomotives left in service on our nation's railroads.

They handled only one-third of the freight traffic and less than one-quarter of the passenger and switching service. Yet, cost for fuel and maintenance alone was $438,739,552.

Diesel locomotives performed the bulk of the service—and could have handled the work done by steam engines with an expenditure for fuel and maintenance of only $198,744,518.

That's a yearly saving of $239,995,034—*or over 50% in fuel and maintenance costs alone.* It figures to an average of $17,127 for each steam locomotive — dollars that may be coming out of *your* pocket.

And this does not take into consideration tremendous additional savings in enginehouse expense, coal haulage, cinder removal, fuel and water station upkeep and track maintenance which complete dieselization will bring. Or further improvements in railroad service through faster, more dependable Diesel operation.

COMPLETE DIESELIZATION WILL SAVE RAILROADS MILLIONS

For further details, write for booklet, "How Complete Dieselization Pays Off."

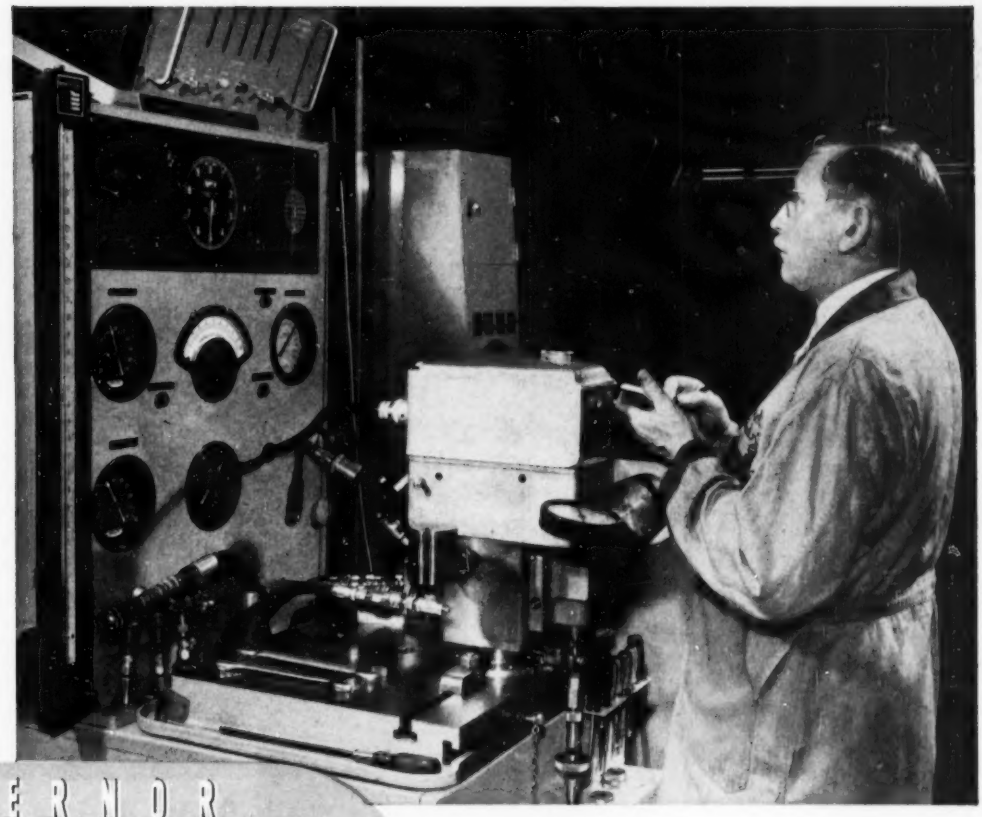
Source of all figures: I.C.C. Reports

ELECTRO-MOTIVE DIVISION
GENERAL MOTORS

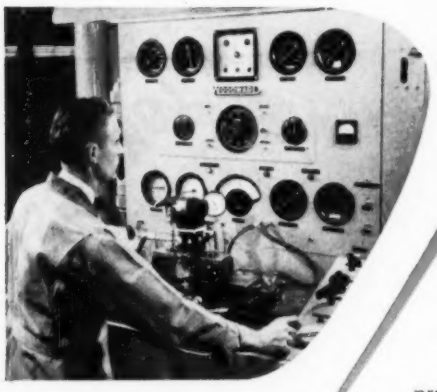
GENERAL MOTORS LOCOMOTIVES

LA GRANGE, ILLINOIS • HOME OF THE DIESEL LOCOMOTIVE

IN CANADA: GENERAL MOTORS DIESEL, LTD., LONDON, ONTARIO



GOVERNOR TESTING



All Woodward governors are given a thorough test under conditions simulating those encountered in the final installation. Test stands are Woodward designed and built to provide for complete governing tests and for all possible adjustments in order to minimize necessity for field calibration. The top view shows diesel locomotive governor test equipment and an airplane propeller governor stand is shown below.

WOODWARD GOVERNOR COMPANY

World's oldest and largest manufacturer of hydraulic governors for prime movers

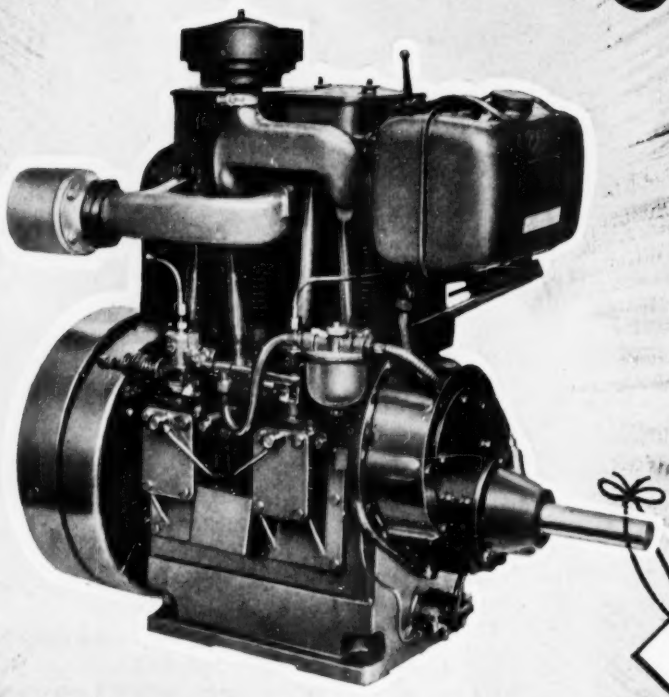
ROCKFORD, ILLINOIS

Petter

Diesel Engines

AIR COOLED
WATER COOLED

3 H.P. TO 40 H.P.



LOW COST

BY A WORLD-WIDE
PARTS AND SERVICE ORGANISATION
FOR THE 350,000 ENGINES IN USE

- MARINE AUXILIARIES
- GENERATORS
- PUMPING EQUIPMENT
- COMPRESSORS
- REFRIGERATION
- OIL FIRED EQUIPMENT

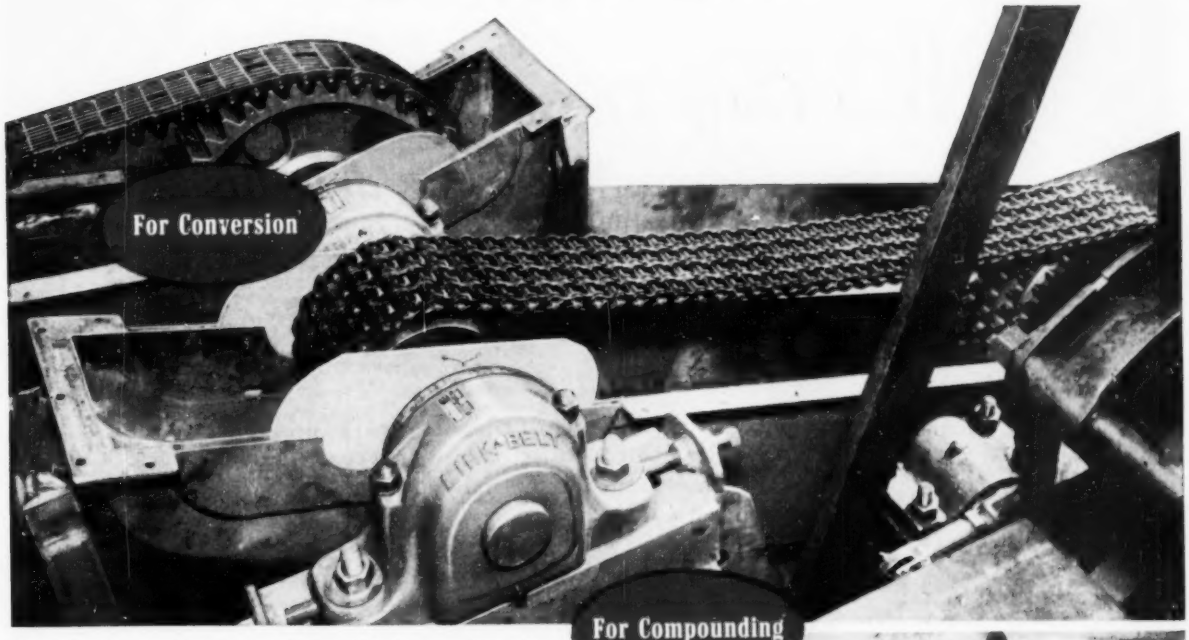
WRITE FOR INFORMATION

A FEW CHOICE DISTRIBUTORSHIPS OPEN

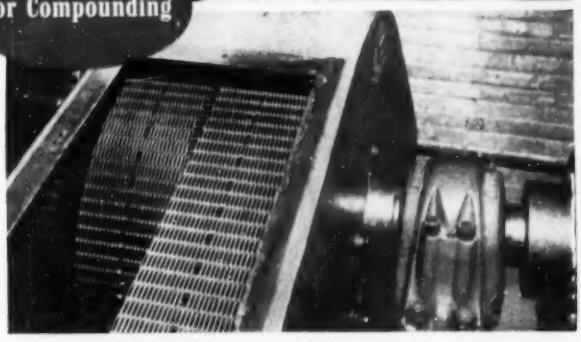
PETTER

ENGINE DIVISION OF BRUSH ABOL

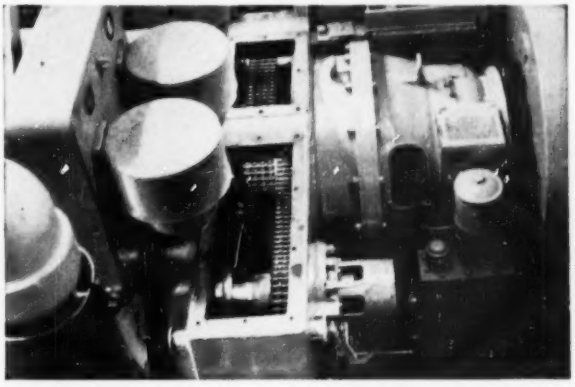
Make LINK-BELT your headquarters for diesel drives



To utilize the best features of each type chain in converting this steam operated locomotive crane to a dieselized unit, the primary drive uses Link-Belt Silverstreak Silent Chain and the secondary drive uses Precision Steel Roller Chain. Also shown, both above and at right, Link-Belt Roller Bearing Pillow Blocks.



To increase flexibility and portability and to speed delivery, many operators today use two or more smaller diesel engines instead of one larger engine of comparable hp. The application above uses Link-Belt Silverstreak Silent Chain to connect four 175 hp engines to the common generator drive shaft. Below: Link-Belt Roller Chain drives used for twinning engines. A series of six engines drives Ideco No. 711 oilwell drilling rig.



Get the right chain for your requirements from the complete LINK-BELT line

Whether it's one of the applications shown here — or any other drive job — you'll find it pays to call in a Link-Belt power transmission engineer. Working with a complete line and backed by Link-Belt's broad experience, he can recommend the *one* drive that best meets your exact requirements. For engineering assistance, call the Link-Belt office near you.

LINK-BELT

CHAIN DRIVES

LINK-BELT COMPANY: Chicago 9, Indianapolis 6, Philadelphia 40, Atlanta, Houston 1, Minneapolis 5, San Francisco 24, Los Angeles 33, Seattle 4, Toronto 8, Springs (South Africa), Sydney (Australia). Offices, factory branch stores and distributors in principal cities. 12,750

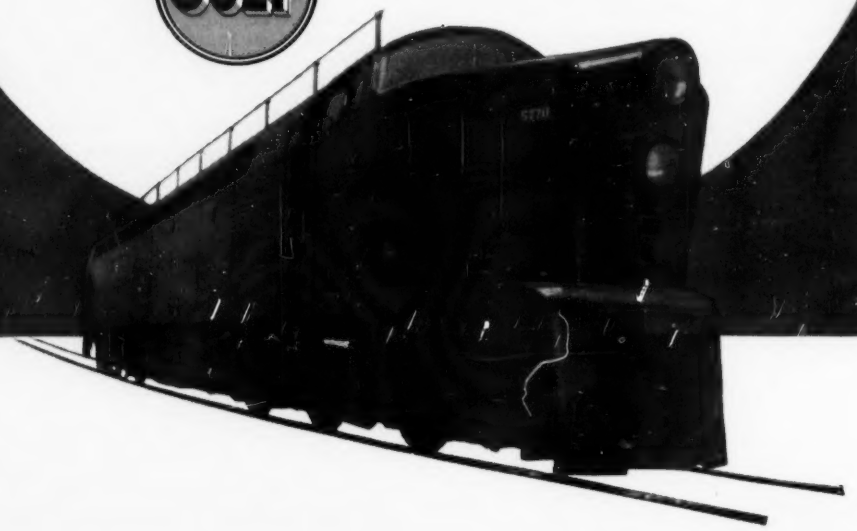
How Gulf Dieselmotive Oil combats harmful engine deposits to increase locomotive availability and reduce maintenance costs:

1. Effective detergent action of Gulf Dieselmotive Oil prevents harmful piston ring belt deposits (has the right combination and the right concentration of the right additives).
2. The selected base stocks for Gulf Dieselmotive Oil insure against hard deposits on the piston crown and area above first ring.
3. The base stocks for Gulf Dieselmotive Oil are 100% solvent refined—this insures greater stability and better bearing protection.

Call in a Gulf Sales Engineer and ask him to recommend the proper grade of this quality lubricant to improve lubrication and reduce maintenance costs for your Diesel locomotives. Write, wire, or phone your nearest Gulf office today.

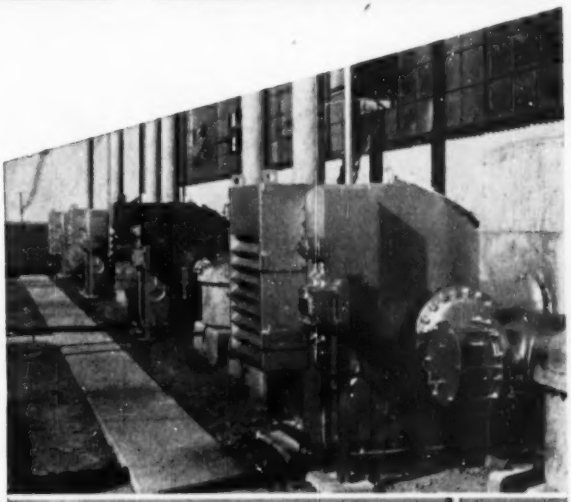
GULF

GULF OIL CORPORATION
GULF REFINING COMPANY
PITTSBURGH 30, PA.



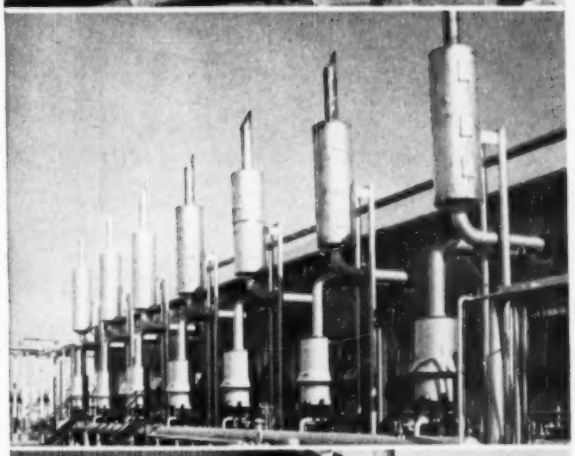
A TRIO of TROUBLE SHOOTERS!

There's a unit in AAF's family of filters to solve every dust problem



1. MULTI-DUTY TYPE CMS

An automatic air filter designed to handle heavy dust loads. Constant, high efficiency self-cleaning, under any load, assures uniform air delivery and low operating resistance. Maintenance consists of occasional sludge removal which is accomplished without shutting down the filter. For outdoor installation, as shown at right, filter is supplied with housing consisting of weather louvres for protection of the filter curtain and a plenum chamber to which engine or compressor intakes are attached. Ask for Bulletin No. 150.



2. CYCOIL AIR CLEANER

This oil bath air cleaner is a "dust bowl" veteran designed for heavy duty service. Regardless of load, the Cycoil operates at approximately 100% efficiency in dust removal. The reason—dirty air is first mixed thoroughly with oil and when the two are later separated by centrifugal action, over 90% of the total dust content of the air is thrown out with the oil. The remaining dust in the air is then removed by the double filter cells at top of unit. Ask for Bulletin No. 130.

3. TYPE "OC-H" FILTERS

These viscous impingement filters are recommended for the protection of engines and compressors operating in industrial districts where the dust to be removed consists of street dust, coke breeze, soot, etc. Advantages of these washable unit-type filters are (1) low resistance to air flow; (2) high cleaning efficiency; (3) large dust-holding capacity; (4) low first cost; and (5) long life. Type "OC-H" filters are complete assemblies consisting of individual unit filters and housing. For outside installation, as shown at right, faces of filters are protected by easily removed weather louvres. Ask for Bulletin No. 120.

Write today for bulletins on any or all of these engine and compressor filters. And remember—experienced AAF engineers are available to consult with you on special dust problems at any time.

Today's Best Buy is Better Air!

AAF

American Air Filter

COMPANY, INC.

445 Central Avenue, Louisville 8, Kentucky • American Air Filter of Canada, Ltd., Montreal, P. Q.

Make it the Biggest Bonus ever— Give it in U.S. Savings Bonds

If your company is one of the more than 45,000 companies that have the Payroll Savings Plan you *know* what your employees think of Savings Bonds—they spell it out for you every month in their Savings Bond allotments.

If you don't have the Payroll Savings Plan, and are wondering whether your people would like to receive their bonus in Bonds, here are a few significant facts:

—every month, *before they get their pay checks or envelopes*—8,000,000 men and women enrolled in the Payroll Savings Plan invest $160,000,000 in U. S. Savings Bonds.

—the ranks of Payroll Savers are growing: On June 30th sales of $25 and $50 Savings Bonds, the sizes purchased chiefly by Payroll Savers, were 6% and 9% higher than in the corresponding period of 1952.

—Payroll Savers hold their Bonds: 75% of the $7,400,000,000 Series E Bonds which had matured up to June 30, 1953, were being retained by their owners beyond maturity under the automatic extension program.

—on June 30, 1953, the *cash value* of Series E and H Bonds—the kind sold only to individuals—totaled $36,048,000,000, a new high.

It costs no more to give your Christmas Bonus in Savings Bonds. To the Payroll Saver, and to the man who buys his Bonds at a bank (because his company does not provide the Payroll Savings Plan) a One Hundred Dollar Savings Bond looks bigger and better than a check for $75. *Make this a merrier Christmas for every employee. Give the gift that keeps on giving.*

The United States Government does not pay for this advertising. The Treasury Department thanks, for their patriotic donation, the Advertising Council and

DIESEL POWER AND DIESEL TRANSPORTATION

THIS YOUNG TUBE-AND-FIN CORE PAYS A BONUS!
● PERMANENT, PERFECT BOND BETWEEN TUBES AND FINS
● GREATER HEAT TRANSFER EFFICIENCY
This die-formed collar provides a tight, permanent bond along entire length of tube as shown in cross section at left.

Here's why Young-designed and built tube and plate fin cores give greater heat transfer efficiency . . . stand up better under peak capacity operation . . . pay bigger dividends in longer trouble-free service. The outstanding design and construction of the Young plate type fin core, shown above, features specially die-formed reinforced collars which make it a continuous, permanent bond between fins and tubes . . . providing maximum heat transfer and greatly stronger, longer-lasting cores.

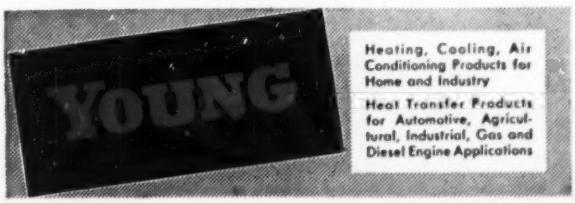
This mechanical structure of greater strength which permits the use of the most desirable metals chosen for the job—copper, aluminum or other alloys—is attributable to Young's precision-manufactured, high-quality cores.

Whatever your need, consult your nearest Young Sales Representative to help you select correct cores —types and sizes—and discuss any phase of your heat transfer problems.

One of our many important installations is the Reynolds Metals Company's new San Patricio, Texas plant which uses more than 80 Young units featuring the new "bonus" core for cooling engine jacket water and lube oil, and 91 additional units of Young variated, specially designed construction.

YOUNG RADIATOR COMPANY

Dept. 413-M Racine, Wisconsin
Plants at Racine, Wisconsin and Mattoon, Illinois
Sales and Engineering Representatives in All Principal Cities


YOUNG
Heating, Cooling, Air Conditioning Products for Home and Industry
Heat Transfer Products for Automotive, Agricultural, Industrial, Gas and Diesel Engine Applications

Leaders in Heat Transfer Engineering for more than 25 years

*CP CONTROLLED PRESSURE

Pressure is something you have to control, whether it's built up on the outside of a deep-sea diving suit, on the inside of a teakettle, or in the bloodstream of an angry or excited person.

Pressure is also a problem when you pump oil through an engine. Sometimes the oil is cold and sluggish. Other times it is hot and easy-flowing. You can't always wait for the oil to be at just the right temperature before you start the engine and need lubrication. You want the lubricant *now*, and you want it clean and dependable. That's the job of your filter.

Most filters don't function properly until the oil has been warmed up. The oil gets by-passed instead of cleaned. But that is not the case when you use Winslow "CP"* (Controlled Pressure) Elements. An exclusive and patented method of constructing Winslow "CP"* Elements makes sure that either hot or cold oil passes through the element instead of the by-pass, insuring positive Full Flow Filtration.

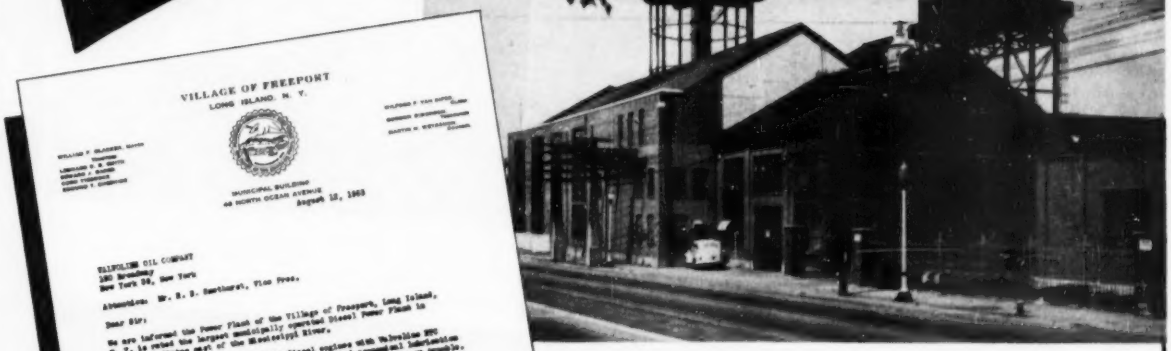
WHY NOT GET FULL INFORMATION ABOUT WINSLOW "CP"* FILTRATION. SEND FOR THE NEW FREE BOOKLET THAT TELLS YOU ALL ABOUT IT!

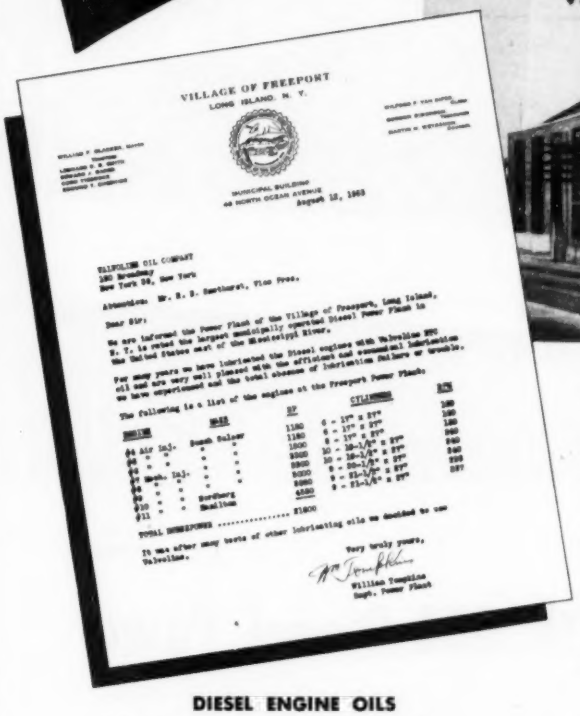
WINSLOW FILTERS

* TRADEMARK

Winslow Engineering Company · 4069 Hollis St., Oakland 8, Calif.

VALVOLINE





VILLAGE OF FREEPORT
LONG ISLAND, N. Y.

MUNICIPAL BUILDING
46 NORTH OCEAN AVENUE
August 12, 1953

VALVOLINE OIL COMPANY
380 Broadway
New York 26, New York

Attention: Mr. R. S. Hartherst, Vice Pres.

Dear Sir:

We are informed the Power Plant of the Village of Freeport, Long Island, N. Y. is owned the largest municipally operated Diesel Power Plant in the United States east of the Mississippi River.

For many years we have lubricated the Diesel engines with Valvoline Oil and are very well pleased with the efficient and economical lubrication we have experienced and the total absence of lubrication failure or trouble.

The following is a list of the engines at the Freeport Power Plant:

UNITS	MAKE	HP	CYLINDERS	RPM
#4 Air Inj.	Busch Sulzer	1150	6 - 17" x 22"	240
#5 " "	" "	1150	6 - 17" x 22"	240
#6 " "	" "	1800	8 - 17" x 22"	240
#7 Mech. Inj.	" "	2500	10 - 18-1/2" x 22"	240
#8 " "	" "	2500	10 - 18-1/2" x 22"	240
#9 " "	Nordberg	3000	9 - 20-1/2" x 22"	257
#10 " "	Meslton	3000	9 - 22-1/2" x 22"	
#11 " "		4500	9 - 22-1/2" x 22"	

TOTAL HORSEPOWER 21800

It was after many tests of other lubricating oils we decided to use Valvoline.

Very truly yours,

William Tompkins
Supt. Power Plant

DIESEL ENGINE OILS

Valvoline "H.P.O." H.D. — SAE 10 to 50
Additives impart extra detergency and resistance to oxidation, corrosion and foaming.

Valvoline SUPER "H.P.O." — SAE 10 to 50
Approved under MIL-O-2104

Valvoline "I.C." DIESEL OILS — SAE 20 to 70
A Mineral Lubricant of high stability

Valvoline R.R. DIESEL OIL — H.D. SAE 40
For locomotive diesels

Valvoline D plus DIESEL OIL
For large low speed diesel engines

It was Valvoline that solved one of the first world-important industrial lubrication problems — valve lubrication of the pioneer Corliss steam engine.

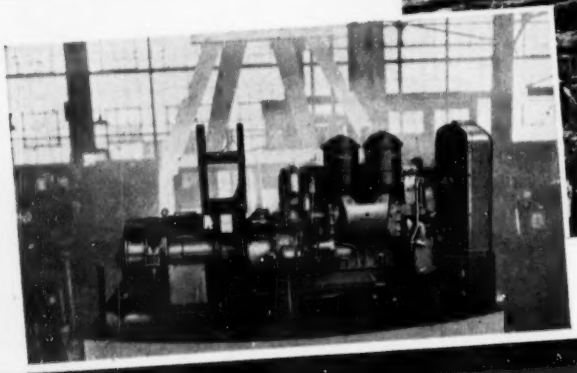
But this historical success was only the beginning of Valvoline's close association with industrial and automotive lubrication problems. It led to recent achievements such as the development of the revolutionary X-5 and X-18 Multi-Purpose lubricants, the widely accepted Tectyl rust preventives, and many other outstanding solutions to present-day problems.

Today, Valvoline serves many of the world's leading industrial plants — offers you the experience and skills of a staff familiar with every type of specialized lubrication. You are invited to consult these specialists — without cost or obligation.

VALVOLINE OIL COMPANY Freedom, Pennsylvania
DIVISION OF ASHLAND OIL & REFINING CO.

GM DIESEL
CASE HISTORY No. 1A6-106

A General Motors 2-cycle Diesel powers this Washington Trakloader shown working near Port Angeles, Washington. The 210-horsepower Model 6-71 engine with its integrated torque converter drives a loading drum, haulback drum and straw drum; also powers the crawler tracks.



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Editorially Speaking . . . .

Stretching Fuel Dollars

"ENJOY that steak because at these prices it is going to be hamburger from now on. If we just didn't have to eat I would have . . . " That's the Ruler-of-the-Household talking. We listen with half an ear, all the while making husband noises, while thinking of parallel cases.

Diesels "eat" too and the cost of their diet is currently a matter of great concern. In just about every field of diesel application, users are looking to burn a less costly fuel. Those burning No. 4 are looking to Bunker fuels; No. 2 users are thinking of intermediate blends; and where bus and truck engines have been using No. 1, they are thinking of No. 2 oils.

Problems are involved in this down-grading process and they are getting top-level attention. For instance, there was a General Technical Meeting, Oil and Gas Power Division, ASME, held in conjunction with the Society's Annual Meeting, where experts discussed these problems. Special emphasis was given to heavy fuel oil preparation for satisfactory engine use, although much of more general interest was also discussed.

We'll give a rundown on the Panel and then a few highlights. Session chairman was R. Wade Seniff, B & O RR. Panel members were F. L. Nelson, Socony-Vacuum; L. D. Thompson, Fairbanks-Morse; Tom Moore, Village of Lowell, Mich.; D. M. Landis, DeLaval Separator; Ray McBrian, Denver & Rio Grande-Western RR; and F. L. Townsend of Nugents.

From the various viewpoints represented, a broad picture was obtained. In this necessarily condensed transmittal of ideas only the major impressions can be conveyed.

We heard of improved refining practices that were cutting deeper into the residum. Then logically we can expect poorer residual fuels. Improvements through treatment or segregation would only raise the costs. We were told of the inevitability of some fuel contamination, both inherent and as the result of handling and transportation.

This was the start of repeated confirmation for the necessity to clean all fuel—and thoroughly. This included dehydration. Shortened service life of injection equipment and increased engine wear are the alternatives. This stresses the importance of cleaning methods.

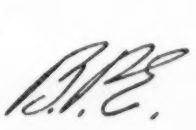
Centrifuges, filters, and strainers all have their role. If you hate to clean centrifuge bowls, there's good news tonight! New designs and techniques are stretching bowl cleaning periods by methods of flushing during operation. Difficulty encountered in purifying oils with specific gravities higher than that of water is being approached by increasing the water's specific gravity by adding an inexpensive salt.

Capacity derating of equipment was stressed as essential when handling heavy fuels. Even with heating, viscosities will be higher and in any case the cleaning problem is more severe. With increased load, filters are also subjected to unusual pressure and heat conditions. This means careful selection of filtering media. Dirt loads can be decreased by proceding the filter with centrifuges and/or strainers.

Mr. McBrian has an electron microscope and uses it. He expounded a whole new theory for evaluating fuels based on what he terms "colloidal chemistry". As we get it, organic and/or inorganic micro-particles in the oil can be seen with the electron microscope. Their size and dispersion are evident. Growth or flocculation of these colloidal particles take place with time, and growth rate is tied in with the oil's stability. He contends that if micro-particle size can be controlled, either by selection of stable oils or possibly use of dispersive additives, fuels normally considered to be substandard can be burned with good results.

It's pretty evident that a lot of people are working on this business of stretching the fuel dollar. This work is important and we'll do our best to keep you up to date next year.

And as to that, right from the Editor's desk—A MERRY CHRISTMAS and HAPPY NEW YEAR.



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Sacramento, Langner & Rifkin, 1116 15th St.
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San Francisco 3, Furrer & Uster, Inc., 225—7th St.
San Francisco 3, H. G. Makelim Magneto Repair Co., 1583 Howard Street
Wilmington, Diesel Control Corporation, 218 North Marine Ave.

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Denver 3, Central Supply Co., 1171 Lincoln Street

FLORIDA

Jacksonville 1, Spencer Electric Co., Inc., 40 West Beaver Street
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Rock Island, Lohse Automotive Service, Inc., 430 North Capitol Ave.

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Houston 11, Magneto & Diesel Injector Service, 6931 Navigation Blvd.
Odessa, Electric Service & Supply, 1601 North Grant Street
San Antonio, Womack Bros., 123 West Carolina

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Salt Lake City 2, Diesel Electric Service & Supply Co., 58 East 7th, South

VIRGINIA

Norfolk, Diesel Injection Sales & Service, 808 Union Street
Richmond 20, Charles H. Woodward Electric Co., 709 Broad Street
Salem, Diesel Injection Sales & Service, 814—8th Street

WASHINGTON

Seattle 1, Seattle Injector Co., 2706 Second Ave.
Seattle 14, Sunset Electric Co., 300 Westlake, North
Spokane 8, Sunset Electric Co., North 703 Division Street

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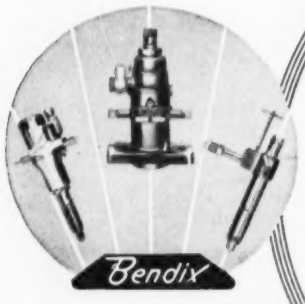

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Minneapolis 2, Reinhard Bros. Co., Inc., 11 South 9th Street

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Cleveland 14, Cleveland Ignition Co., 1301 Superior Ave., N. E.

OKLAHOMA

Tulsa 3, Magneto Ignition Co., 701 West 5th St.

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Hazelton, Penn Diesel Service Co., No. Church at 27th St.
Philadelphia 32, J. W. Parkin, Jr., 2251 North Broad Street
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BRITISH COLUMBIA

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+ HIGHLIGHTS +

● Louisiana produces enough oil in 10 days to pay for the Louisiana Purchase.

● During September of 1953, Class I railroads installed in service 118 new locomotive units.

● Annual Meeting and Engineering Display of the SAE will be held from January 11 to 15, 1954 at the Sheraton-Cadillac and Statler Hotels in Detroit, Michigan.

● Armour Research Foundation recently announced the development of a "global grease," said to perform effectively in desert heat or arctic cold, by the Texas Company.

● Winter General Meeting of the American Institute of Electrical Engineers is scheduled for January 18 to 22, 1954. The place—Hotel Statler in New York City.

● At least $300,000 must be spent for a fully equipped oil well drilling rig which weighs in the neighborhood of 200 tons, according to the American Petroleum Institute.

● Total number of locomotive units owned by Class I railroads as of October 1, 1953 was 29,161. Of this amount, 95.1 per cent was in serviceable condition.

● The Plant Maintenance and Engineering Conference and Plant Maintenance and Engineering Show will be held concurrently at the International Amphitheater and Conrad Hilton Hotel in Chicago, Ill. from January 25 to 28, 1954.

● According to ICC Commissioner Hugh W. Gross, during the period from 1939 to 1951 "the ton miles handled by Class 1, 2, and 3 interstate trucking companies increased 268 per cent, while the ton miles hauled by rail increased 94 per cent".

● If dynamite is set off in the middle of an uninhabited area, is there no noise because the explosion is not heard by anyone? Mr. A. P. Fugill of the Detroit Edison Company answered that riddle recently at the National Noise Abatement Symposium at Armour Research Foundation. "Noise," he said, "is a wave motion which becomes noise only when it causes the human ear to respond."

● Class I motor carriers, or those with $200,000 or more annual gross operating revenue, increased by 183 during 1952 to a total of 2361.

● It is expected that by the time this issue is published, work on the Army's Alaska pipeline will have been started, since the contractor faces a completion date of September 1, 1955.

● Chalfonte-Haddon Hall in Atlantic City, New Jersey will be the scene of the American Road Builders Association's annual convention. The date—January 10 to 13, 1954.

● During the 12-month period ending September 30, 1953, Class I railroads placed 2313 diesel-electric locomotive units in service. During this same period, 18 steam locomotives were also placed in service.

● The Bureau of Public Roads recently estimated that a new high of more than 3 billion dollars for road construction will be reached this year.

● The ASME annual meeting at the Hotel Statler, held in New York early this month, was so large that it overflowed into the meeting rooms at the Hotel McAlpin. This was the second year the annual meeting was held in New York. If you missed this one, try the annual conference of ASME's Oil and Gas Power Div. at the Muehlebach Hotel in Kansas City, Mo.—June 14 to 17, 1954.

● As of October 1, 1953 there were 548 locomotive units on order by Class I railroads.

● Emergency stand-by power for the Navy's new megawatt transmitter will probably be diesel.

● November 16 to 22 will be Truck Transportation Week in commemoration of the golden anniversary of motor trucking in the United States.

● Over the past two years, oil operators have laid more than 9350 miles of crude oil and products pipelines. Pipelines cost roughly $30,000 a mile to lay.

● The Hotel Statler in Buffalo will be host to the American Welding Society from May 4 to 7, 1954. The event—1954 National Spring Technical Meeting.

● Class I railroads of the United States employ approximately 43,000 locomotive engineers and 50,000 locomotive firemen and helpers, according to AAR.

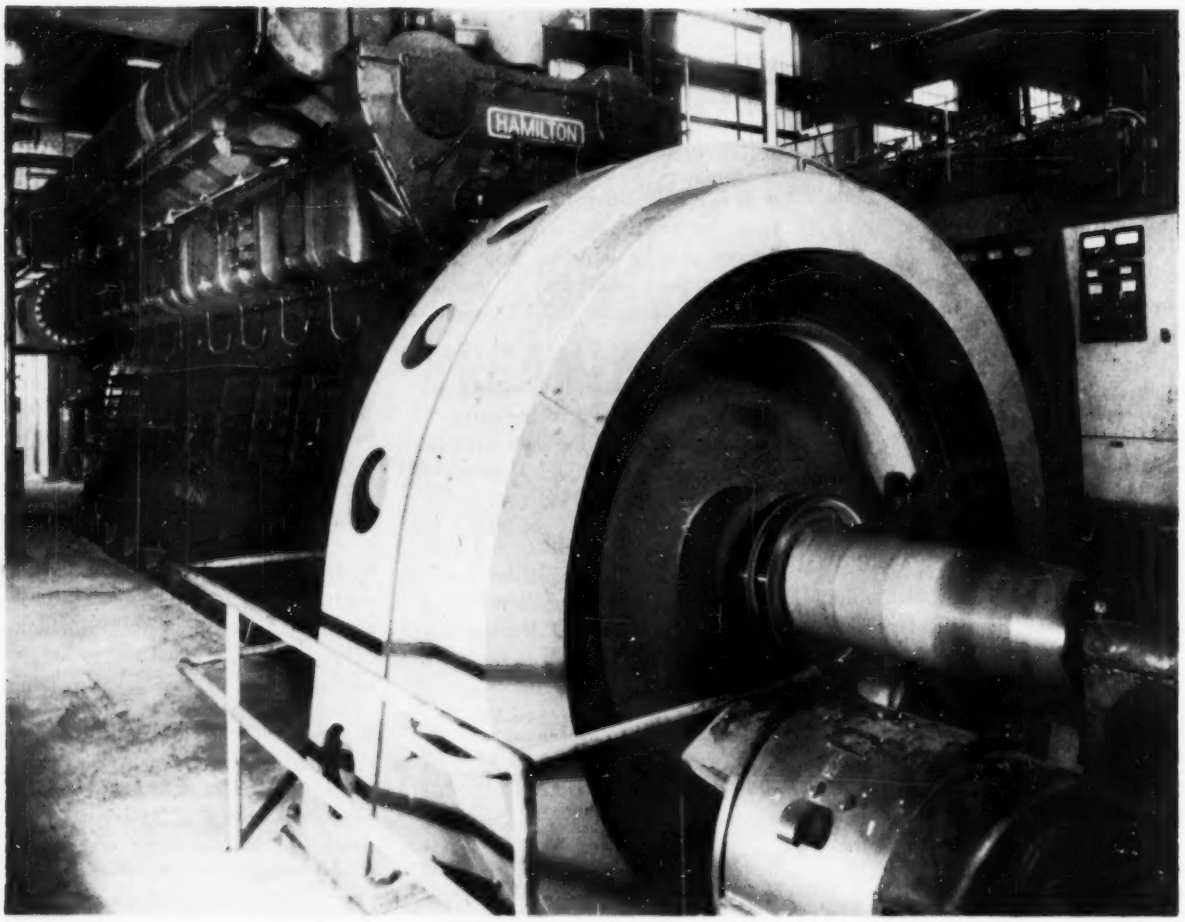
● A gallon of diesel fuel in a diesel-electric locomotive will perform almost six times the work of a gallon of fuel oil consumed in a steam locomotive.

● According to the API, drilling for oil entails heavy financial risks. Eight out of every nine wildcat wells, for example, turn out to be dry holes in which almost the entire investment is lost.

● A group of leading educators has recommended a series of college-level courses leading to degrees in the general transportation field. The recommendations were made at a 2-day meeting between nine college professors and two subcommittees of the ATA's National Committee on Education.

Hamilton Engine—Freeport's Latest

Freeports latest addition—a Model 921SA Hamilton engine rated at 4350 horsepower.



Latest addition to the Freeport municipal plant is a

FREEPORT, New York has been in the power generation business since 1897. At present, the fininshing touches are being put to the installation of a Model 921SA Hamilton engine which will eventually be operated on Bunker "C" fuel. In addition to this, new switchgear is being installed for the entire plant. However before we go into the engine installation and heavy fuel system, let's take a look at some of Freeport's history.

Over the Years

Prior to the installation of its first diesel, the community was producing power with steam-driven generators. This was prior to 1921, at which time Freeport installed its first diesel generating unit, a 360-hp, 4-cycle, air injection Busch-Sulzer engine. The primary reason for installing this unit was to supplement the steam generating equipment then in use, and to cut operating costs. In the following years, a long line of Busch-Sulzer engines were installed. Almost every time a successive engine was installed, it was of higher capacity.

The second engine was a 750-hp air injection unit of 2-cycle design. This was installed in 1923, with a similar unit following in 1924. By 1927, more power was needed. At this time an 1150-hp, 6-cyl engine was added. Before this engine was completely installed a similar unit was ordered.

Plant load continued to grow and in 1929 an 8-cyl, 1500-hp engine was installed. This was followed by a 3300-hp unit in 1932 and another 3300-hp engine in 1936. Thus, with a total installed nameplate capacity in the order of 11,560 hp at the end of 1936, Freeport was considered to be the largest municipally-owned diesel generating station east of the Rocky Mountains.

Still another Busch-Sulzer engine followed, and then in 1949 a 3850-hp Nordberg turning at 225 rpm was installed. This was engine No. 10. Several of the older engines were retired through the years and there are presently 8 engines in service including the new unit.

Now, Number 11

As mentioned previously, this unit is a Model 921SA Hamilton engine, rated 4350-hp at 257 rpm. Bore and stroke are 21½ in by 27½ in respectively. The engine is of 2-cycle in-line design and is loop-scavenged. Featured in the design are rotary exhaust valves which are designed to entrap 40 per cent more air in the cylinder, thus providing additional air for combustion.

Rugged, heavy-duty construction is used throughout. Pre-stressed through-bolts, located between each cylinder and at the front and rear of the engine, tie the bed plate, upper base and the blocks together. Main bearings are carried in the bed plate and supported by heavy webs. Bearing saddles are held in place by jack-bolts which extend from the top of the saddles to a cross member in the upper base.

The crankshaft is a one-piece drop forging of SAE 1035 steel and thoroughly machined to close tolerances. Connecting rod bearings are precision-type and are inserted in a bearing box which bolts to a footed connecting rod. Pistons are of the trunk-type and incorporate oil cooling in the cast iron piston head. Piston pin design permits the entire upper half of the pin to be utilized as bearing surface. Here again, a footed design is used with the smaller foot bolting to the piston pin.

Injection equipment is of the American Bosch manufacture and consists of APF-type injection pumps and hole-type nozzles, designed to handle both heavy and light fuels.

Heavy Fuel System

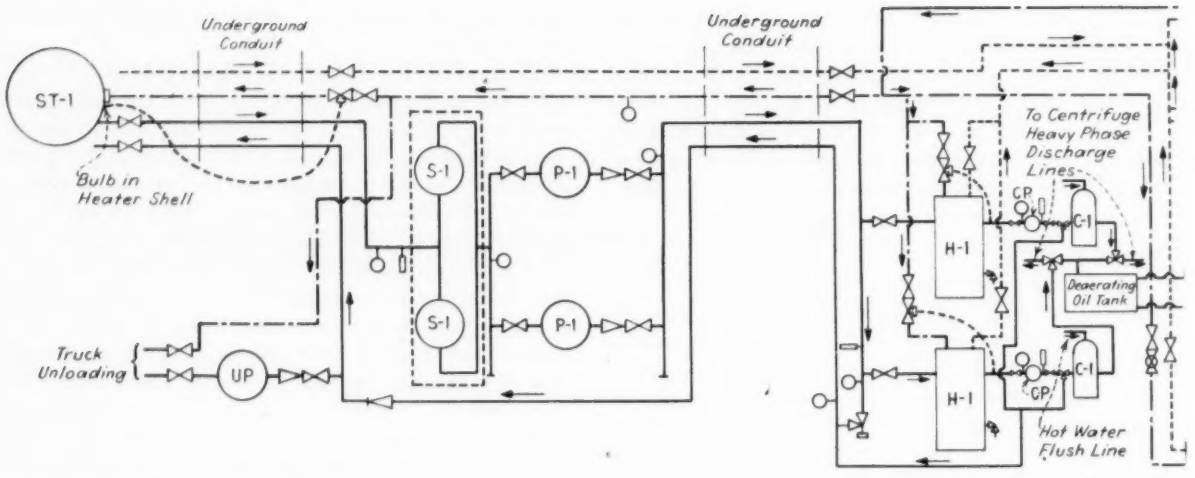
Since both heavy and light fuel oil will be burned in the new engine, it has been necessary to design and install an elaborate piping and handling system. The heavy fuel is heated by steam coils at several points in the system. Heavy fuel is maintained at a predetermined temperature from the time the fuel is delivered until the time it reaches the fuel header on the engine.

Heating the bunker "C" fuel is necessary to bring the viscosity to within practical limits for filtration and pumping. After the handling and preparational phase, still more heating is necessary to reduce its viscosity to a point where the injection equipment can handle it.

Included in the heavy fuel system are a 126,000-gal storage tank behind the plant, a clean fuel storage tank of 5000-gal capacity located in the plant basement, and a day tank at one side of the engine foundation. Between the unloading point and the engine header, the heavy fuel is heated and reheated at various stages in addition to being strained, centrifuged, and filtered. It will be noted in the following that pumps are arranged in parallel with suitable valving so that either or both may be operated.

Thermometers have been installed in the fuel lines at numerous points in order to maintain a close check on fuel temperatures. Also, pressure gauges before and after filters and strainers, have been provided in order to keep tabs on pressure drop across filtering and straining elements. At several points, return lines are provided so that heavy fuel may be kept circulating, thereby maintaining temperatures at proper levels. Fuel temperatures are controlled by automatic valves in the steam lines to the units where heating takes place, and the valves in turn are controlled by temperature-sensing elements in the oil discharge line from the heating unit. Now, let's start at the unloading point and follow the fuel lines to the engine.

Model 921SA B-L-H engine. Featured in this installation is a heavy fuel system for the utilization of Bunker "C".



ST-1 Bulk Storage Tank (100,000-gal)
ST-2 Clean Oil Storage Tank (5000-gal)
ST-3 Light Oil Day Tank (275-gal)
ST-4 Heavy Oil Day Tank (275-gal)

S-1 Strainers (1200-gph)
P-1 Transfer Pumps (600-gph)
P-2 Filter Pumps (1200-gph)
P-3 Day Tank Fill Pumps (1200-gph)

P-4 Engine Supply Pumps (600-gph)
UP Unloading Pump (2400-gph)
CP Centrifuge Metering Pumps
C-1 Centrifuges (400-gph)

Unloading facilities are provided for heavy fuel delivery by tank truck. At this point, behind the plant, a steam line has been installed to facilitate unloading. A 2400-gph unloading pump, located in the pump house to the rear of the plant, transfers the fuel underground to a 126,000-gal heavy oil storage tank.

Paralleling the fuel lines to and from this storage tank are steam and condensate return lines. The steam line supplies heat to a withdrawal-type heater on the heavy fuel take-off line. An automatic regulating valve in the steam line, with a sensing element in the fuel take-off line, controls the fuel temperature.

In the pump house are the two 600-gph transfer pumps, valved to permit operation of either or both in parallel. Fuel oil from storage passes through two strainers in parallel before entering the pump. Pump discharge goes through "Ric-wel" conduit to the plant.

Fuel enters a header in the plant basement which is connected to the inlet sides of two 400-gph heaters in parallel. A constant-pressure control valve at one end of the heater inlet header permits excess fuel to return to the heavy fuel storage tank. Here again a steam regulating valve controls the fuel discharge line temperature.

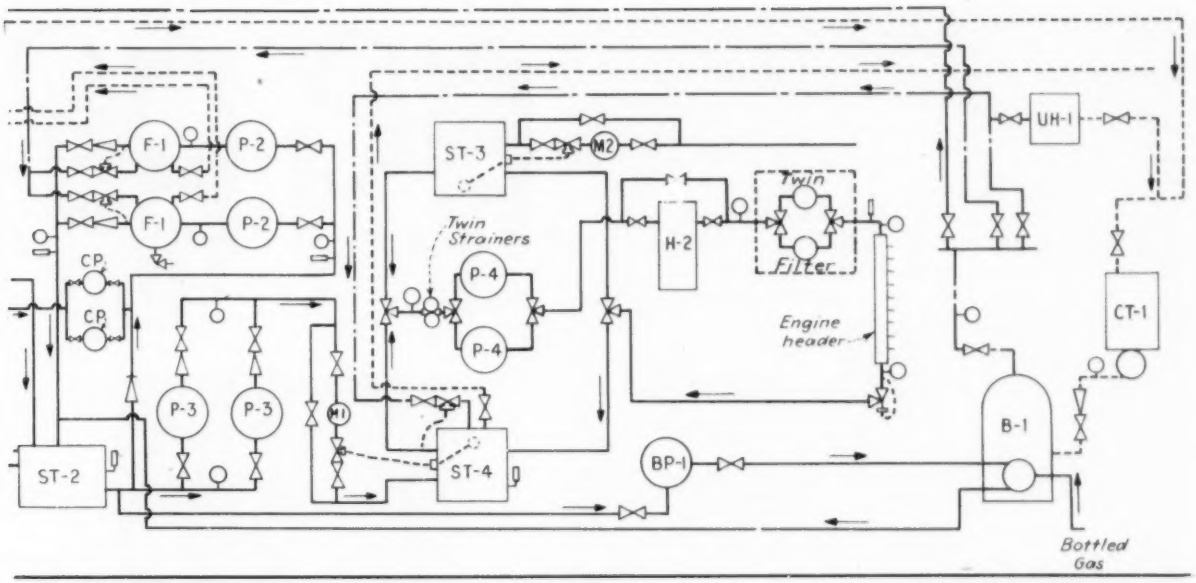
Centrifuge fill pumps in each heater discharge line meter the heavy fuel through 3-way valves to the centrifuges. The 3-way valves permit selective bypassing of heavy fuel to the storage return line until fuel at the proper temperature reaches the centrifuge. Fuel is discharged from the centrifuges through 3-way valves to a common header. These 3-way valves permit fuel to flow to heavy phase discharge line, which returns fuel to storage, or to the deaeration tank.

From the deaeration tank, the fuel passes through a single line to parallel pumps called centrifuge discharge pumps. These pumps meter fuel to a header which supplies two 1200-gph filter pumps connected in parallel. At this point, fuel from the centrifuge mixes with fuel from clean oil storage which is kept circulating through the filters constantly.

Each filter pump supplies a 1200-gph filter which is equipped with automatically controlled steam heat. The method of controlling the fuel oil discharge temperature from the heater is the same as mentioned previously.

Fuel from the filters is discharged into a 5000-gal clean oil storage tank located in the plant basement. This storage tank is also equipped with a thermostatically-controlled heating element which maintains clean stored fuel at the proper temperature level. A line from the overflow in the deaeration tank also connects to the clean fuel storage tank.

From the storage tank there are three connections to the take-off line. One supplies the heavy fuel day tank, the second feeds the donkey boiler, that supplies the steam for fall heating, and the last is a recirculating line. This recirculating line permits heavy fuel to be drawn from the storage tank through a check valve in the line to the filter pumps and then through the filters. Once



H-1 Heaters 400-gph)
F-1 Filters (1200-gph)
M-1 Heavy Oil Flow Meter (1200-gph)
M-2 Light Oil Flow Meter (1200-gph)

UH-1 Unit Heater
B-1 Oil-Fired Boiler (80-hp)
CT-1 Condensate Storage Tank
BP-1 Boiler Fuel Oil Pump

H-2 Booster Heater
Solid line—Fuel
Broken line—Steam
Dotted line—Condensate return

through the filters, the fuel is returned to the clean heavy fuel storage tank.

The take-off line for the day tank connects to two parallel 1200-gph transfer pumps which discharge into a single line running to the heavy fuel day tank. Installed in this line is a fuel meter and an automatic air-actuated shut-off valve. The valve is controlled by a float in the day tank and regulates the day tank level. There is a bypass around the fuel meter and air-actuated fill valve.

The heavy fuel tank is heated by an arrangement similar to those previously explained. Fuel from the heavy oil day tank next passes to a 3-way valve. It is at this point that the light fuel ties in to the system. However, since we are primarily concerned with the operation of the heavy fuel system and the light fuel system arrangement is conventional, the balance of the system will be traced with reference to the heavy fuel.

From the 3-way valve, fuel passes through two strainers in parallel and then to another 3-way valve. At this point, two parrellel 600-gph fuel booster pumps take over. These pumps discharge through a 3-way valve to a single line which connects to a booster heater for heavy fuel. Light fuel is bypassed around the automatically controlled heater and connects to the heater line on the outlet side. This line connects through a 3-way valve to twin filters in parallel.

Filter outlet lines run to a 3-way valve, the third side of which connects to the fuel header on the engine. A constant-pressure control valve at the other end of the engine header allows excess fuel to bleed off to a 3-way valve. Fuel from the 3-way valve can be returned to fuel day tanks selectively. This is important in the use of heavy fuel as it must be maintained at a constant, predetermined temperature and must be kept moving.

A portion of the heavy fuel system has not yet been covered. This is the boiler fuel system and although not actually part of the engine fuel system, it is integrated to the extent that it furnishes steam for the various heaters and operates on heavy fuel. Fuel for the boiler is taken directly from the clean heavy fuel storage tank by the boiler fuel oil pump. Here again a heavy fuel return line is provided. This return line discharges in the clean heavy fuel storage tank. A line from bottled gas tanks is also connected to the boiler. The bottled gas supplies the boiler pilot.

According to Mr. H. D. Ege, supervising the installation for Burns and McDonnell Engineering Co., the heavy fuel will have to be heated to approximately 100°F in order to be pumped from the outdoor storage tank. Temperature of the fuel will be increased to approximately 160°F upon entering the plant, before centrifuging and filtering take place. It is also estimated that the temperature of clean fuel to the engine will be in the neighborhood of 200°F. Exact temperatures are not known at this writing since the heavy fuel system is not yet in operation. Actual operation of the engine on Bunker "C" will dictate what the exact temperatures will be.

Cooling System

A closed cooling system incorporating a shell-and-tube-type heat exchanger is used on this engine. Water is circulated through the engine water jackets and the heat exchanger by a motor-driven pump located in the plant basement adjacent to the operating end of the engine.

Also located in the plant basement is a motor-driven raw water pump. This pump circulates raw water from the induced-draft cooling tower, located behind the plant, through both the jacket water cooler and in the lube oil cooler. At present, no jacket water treatment is used for the new engine.

Lube Oil System

Both circulating pressure and force-feed lubrication are provided. Cylinder lubrication is provided by a bank of force-feed lubricators mounted just below the platform near the generator-end of the engine. A pair of lube oil circulating pumps are located in the plant basement adjacent to the lube oil sump tank at the operating end of the engine.

Oil is used for piston head cooling as well as lubrication of the engine parts. Lube oil cooling is accomplished by means of a vertically mounted shell-and-tube type heat exchanger in the raw water line at one side of the engine foundation in the plant basement.

A lube oil purifier and twin lube oil strainers are also provided. The purifier is mounted on the same level as the engine and is supplied by a motor-driven pump located directly below in the basement. Lube oil strainers are also located in the basement adjacent to the lube oil sump tank and pumps.

Intake and Exhaust Systems

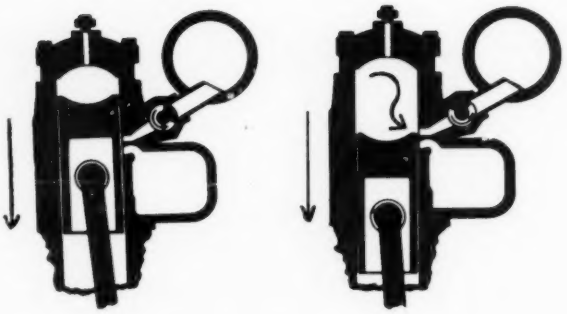
Air is taken in through a silencer mounted atop a lowered section of the building directly behind the engine. Below the silencer, air passes through a self-cleaning, viscous impingement-type air filter mounted in a vertical position between two chambers. The motor-driven scavenging air blower takes filtered air from the second chamber and supplies it to the engine at approximately 3 psig.

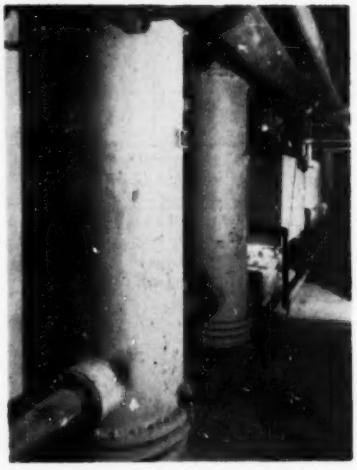
At this point, we come to the rotary exhaust valve, a feature of 2-cycle Hamilton design. After combustion, the rotary exhaust valve is positioned such that it allows blow-down to occur as the cylinder exhaust ports are uncovered. As the scavenging port is uncovered, cylinder pressure is about 3 psig below the scavenging air pressure.

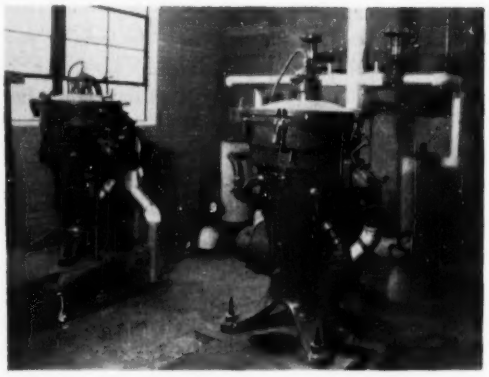
When the piston returns on the compression stroke, the rotary valve closes off the exhaust ports before the piston covers the scavenging ports. This action eliminates a drop in cylinder pressure as would normally occur since the exhaust ports are located above the scavenging ports. By the time the exhaust ports are covered by the piston, cylinder pressure has reached a point between 7 and 8 psig, rather than dropped to nearly atmospheric.

Control Cubicles

Directly adjacent to the operating end of the engine is a control cubicle equipped with pyrometer; heavy and light fuel level gauges; pressure gauges for jacket water, lube oil, starting air, and fuel oil; and an annunciator panel. Audible and visual alarms are automatically actuated for high or low engine oil pressure, high or low jacket water pressure, high or low level in the light or heavy fuel day tanks, or blower overload.



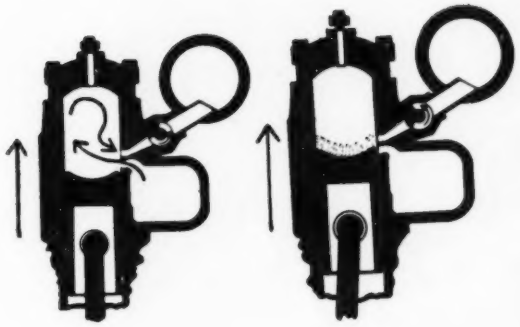




Switchgear for the engine is positioned at the generator end of the engine as is the switchgear for other units in the plant. At this writing, switchgear for the entire plant is being replaced with new equipment.

General

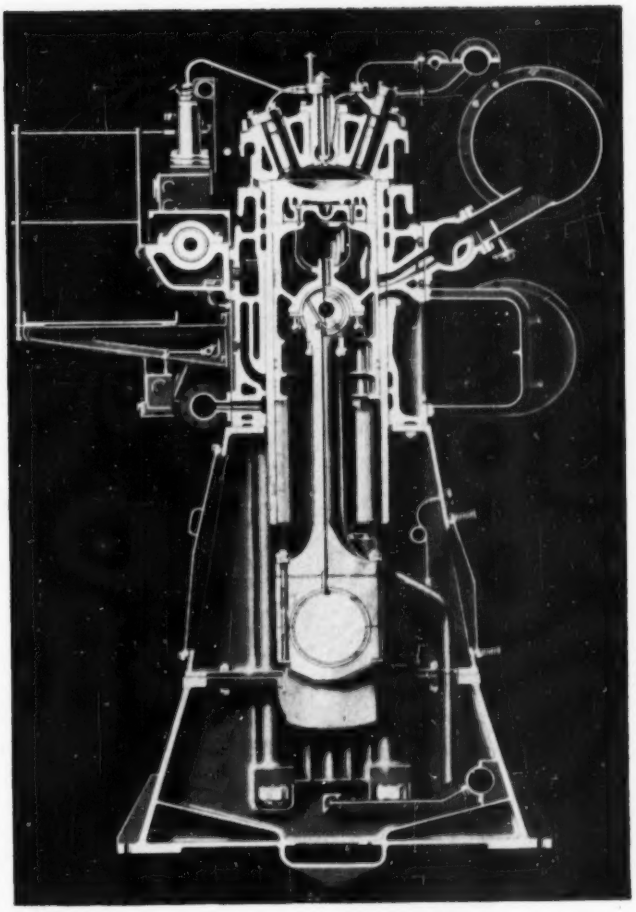
Freeport is one of the largest diesel-powered municipal generating stations in this country. Its first engine



Operation of the rotary valve is illustrated in the four figures at the top. From left to right are expansion, exhaust, scavenging and extra charging. The rotary valve opens to permit blowdown and remains open to permit scavenging. Extra charging occurs when the rotary valve and scavenging port are closed simultaneously, eliminating the usual drop in cylinder pressure at this point.

At left, is a view down the side of the engine foundation in the plant basement showing the heat exchangers and light and heavy fuel day tanks. The lower illustration shows the two centrifuges and steam-heated heavy fuel filters. Note temperature regulating valves for filters installed in steam lines.

At right, a cutaway end view of Model 21-SA Hamilton engine.

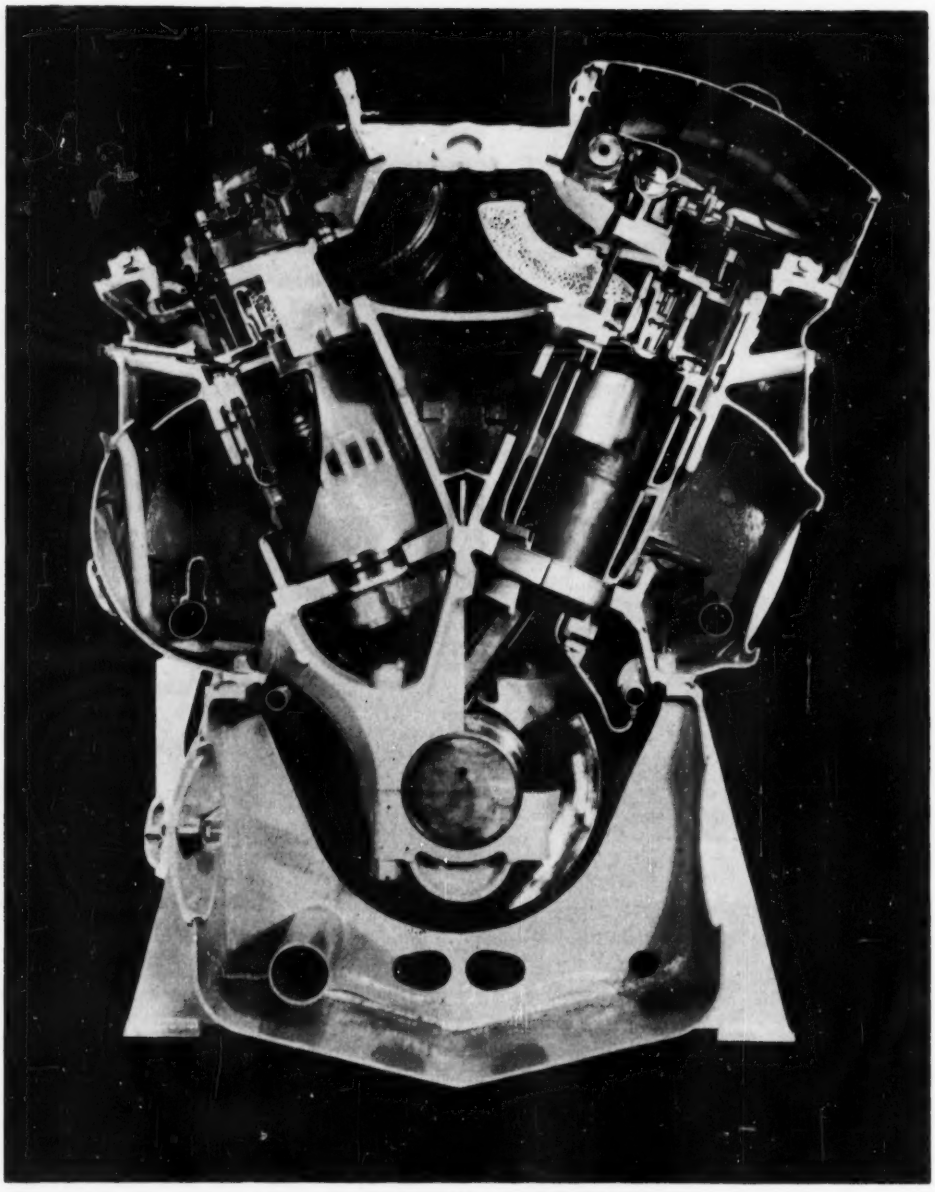


was removed to make room for a larger unit and at last reports is still in operation in South America. Incidentally, Mr. Stanley Wright, who sold Freeport its first Busch-Sulzer, is currently representing Baldwin-Lima-Hamilton in the New York area.

Responsible for operation of Freeport's municipal power plant is Mr. William W. Thompkins, superintendent. Burns and McDonnell Engineering Co. of Kansas City, Missouri were the consulting engineers for the installation of the new engine.

New Engine and Principal Equipment

Engine	Baldwin-Lima-Hamilton Corp.
Generator	General Electric Co.
Exciter	General Electric Co.
Blower	Ingersoll-Rand Co.
Motor	General Electric Co.
Governor	Woodward Governor Co.
Lube Oil System	
Pump	DeLaval Steam Turbine Co.
Motors	Elliott Co.
Filter	U. S. Hoffman Machinery Corp.
Pump	Worthington Corp.
Motor	Allis-Chalmers Mfg. Co.
Strainers	J. A. Zurn Mfg. Co.
Heat Exchanger	Kewanee-Ross Corp.
Force Feed Lubricators	Manzel
Cooling System	
Raw Water Pump	DeLaval Steam Turbine Co.
Jacket Water Pump	Ingersoll-Rand Co.
Heat Exchanger	Kewanee-Ross Corp.
Starting Air Compressor	Ingersoll-Rand Co.
Motor	Crocker-Wheeler Electric Mfg. Co.
Intake Air Filter	American Air Filter Co., Inc.
Intake and Exhaust Silencers	Maxim Silencer Co.
Fuel Oil System	
Centrifuges	DeLaval Separator Co.
Filters	Commercial Air Filter Co.
	Wm. W. Nugent & Co., Inc.
	Air-Maze Corp.
Pumps	DeLaval Steam Turbine Co.
	Viking Pump Co.
Injection Equipment	American Bosch Corp.
Switchboards	Westinghouse Electric Corp.
Control Cubicle	Lake Shore Electric Co.
Fuel Level Gauges	Liquidometer Corp.
Water, Air, Fuel, and Lube Gauges	Weksler Co.
Annunciator Panel	Viking Instruments, Inc.
Pyrometer	Minneapolis-Honeywell Regulator Co.
Instrumentation	
Temperature Regulators	Powers Regulator Co.
Manometer	Uehling Instrument Co.
Thermometers	Palmer Co.
	Weston Co.
	Rochester Mfg. Co., Inc.
	Acuragage Co.
Boiler	Cleaver-Brooks Co.
Fuel Heater	Edwin L. Wiegand Co.
Fuel Filter	Cuno Engineering Corp.



Cutaway view of Electro-Motive's Model 567-C diesel.

PREVIEW OF EMD's '54 LINE

January 1954 will mark the introduction of ten EMD locomotive models incorporating some interesting design improvements and recently announced 567C engine.

A thousand horsepower increase in the propulsion power of a 4-unit diesel freight locomotive is one of the improvements in a new line of ten types of railroad motive power announced by the Electro-Motive Division of General Motors at La Grange, Ill.

The 4-unit freight locomotive power is increased from 6000 to 7000 hp. This is 1600 more than the horsepower rating of the first diesel-electric freight locomotive brought out by EMD in 1940, reflecting technological advance in the locomotive field over the 13-year period.

Deliveries of these locomotives from EMD plants in La Grange and Cleveland, Ohio will begin in January 1954, according to N. C. Dezendorf, vice president of General Motors and general manager of EMD. Each model is marked by the upgrading of its capabilities over those of the current models.

Most of the increases in ratings or in service life stem from the introduction of the GM 567C series diesel, upon which EMD engineers have been working for five years, and from an improved traction motor which, in Mr. Dezendorf's words, "makes possible the elimination of arbitrary short-time ratings for all models and all gear ratios".

"The new models represent achievements from the series of development projects which are continuously carried on at Electro-Motive and which are aimed at improving performance and 'engthening life of the locomotives and reducing maintenance costs," Mr. Dezendorf added. The traction motors along with the higher ratings of the 567C diesel engine, make it possible to haul more tons or haul the same tonnage faster.

Other major improvements in the locomotives include a sealed gear case with a newly developed stable lubricant which reportedly provides up to ten times the previous lubricant performance. In test runs, this gear case has run on western railroads for more than a year in heavy service without loss or addition of lubricant.

Electrical control apparatus has been simplified through the use of newly developed contact materials and more direct mechanical motions eliminating joints, bearings, complicated linkages, and flexible shunts. Controls are designed for 6-year maintenance-free operation.

Wheel slip control and automatic sanding equipment has been designed to effectively utilize the greater horsepower and tractive effort. Larger engine cooling capacity and a new brake rigging stabilizer are other outstanding features.

The '54 models and their major improvements are as follows:

F9 Freight and/or Heavy-Duty Passenger and FP9 Freight and/or Heavy-Duty Passenger . . . increased from 1500 to 1750 hp per unit.

GP9 General Purpose and SD9 Special Duty . . . increased from 1500 to 1750 hp.

E9 High-Speed Passenger . . . increased from 2250 to 2400 hp per unit.

SW600 Yard Switcher . . . 600 hp; increased life of components.

SW900 Yard Switcher . . . increased from 800 to 900 hp; increased life of components.

SW1200 Yard Switcher . . . increased life of components.

TR9 Transfer . . . increased from 1600 to 1800 hp.

TR12 Transfer . . . 2400 hp; increased life of components.

567C Engine

The 16-cyl version of the 567C provides 1750 hp for propulsion. Its maximum rpm is 835 against 800 of its predecessor. Its size has not been increased. This 16-cyl engine powers the F9, FP9, GP9, and SD9 models. The engine in all sizes (6, 8, 12, and 16 cyl) has an entirely new crankcase designed for longer service life.

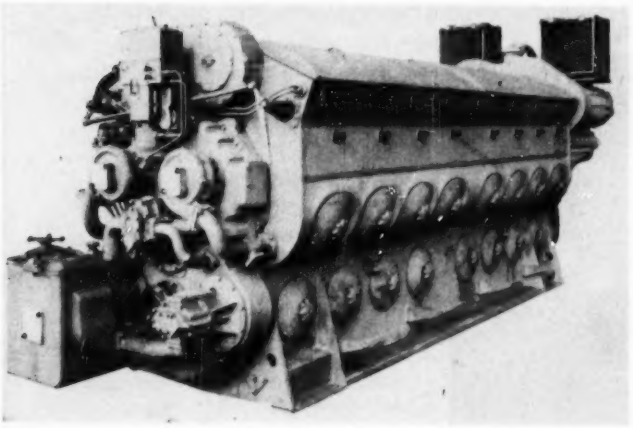
Frame members are heavier and the stress level of the entire crankcase is reduced in spite of the higher horsepower output. Large water seals on cylinder liners and heads are eliminated through the use of replaceable water inlet manifold jumper lines individually connected to liners and heads. Stress plates no longer are subject to corrosion by water. Small synthetic seals are used and a new replaceable wear ring for the lower liner pilot takes wear off this integral part of the crankcase. The engine also incorporates high output injectors and improved cylinder head cooling.

In the new locomotives, where the higher horsepower capacity of the 16-cyl 567C engine is utilized, engine cooling capacity is increased. Six-inch radiator cores are used on the F9, FP9, GP9, and SD9.

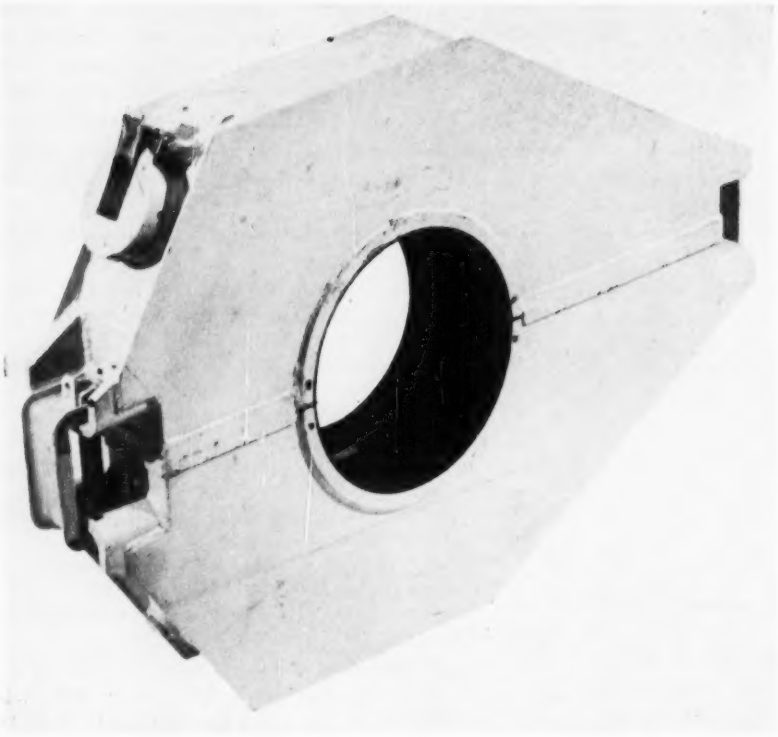
New Traction Motor

A molded coil, which seals out moisture, permits a substantial increase in traction motor ratings with the elimination of arbitrary short-time ratings. Along with the improvements in electrical performance and mechanical reliability of the field coils, mica in the armature coil pad has been entirely replaced with Teflon, the new insulating material which reduces chafing because of its remarkably low coefficient of friction.

With these developments, both the stator and the armature of the new motor can reportedly operate at higher ratings with actually lower temperatures than its predecessor. This means longer life and less maintenance. The new motor also incorporates the recently developed sealed



View of the 567-C from the auxiliary end.



Featured in the EMD '54 line will be a final drive gear box which makes use of a new stable lubricant.

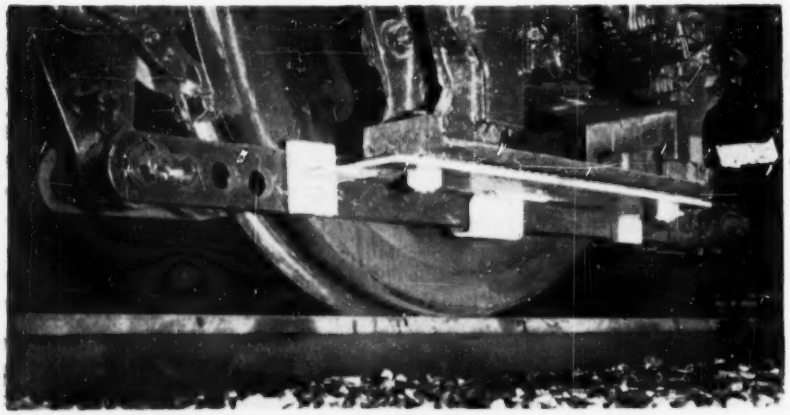
lubricant armature bearings and a molded polyester glass insulated brush holder which can withstand flash-overs without damage.

Automatic Wheel Slip Control

Wheel slip control has been incorporated in F9, FP9, GP9, SD9, and E9 locomotives, designed to improve operation under slipping conditions and at the same time reduce sanding requirements. The system consists first of a sensitive creep relay which anticipates slipping and automatically applies sand and reduces power from main generator to traction motors during wheel slip, then gradually reapplies the power under controlled conditions to effect maximum utilization of available adhesion.

The E9 also is equipped with an improved system of high-speed wheel slip control which aids in eliminating that operating disadvantage. In addition to more effective utilization of increased power and tractive effort, these developments also reduce electrical maintenance by eliminating severe shocks caused by uncontrolled wheel slips.

Interchangeability of parts between engine sizes and earlier models of the GM 567 series engine, which has been traditional at EMD, is maintained in the new 567C series.



A brake rigging stabalizer (shown in white) will also be introduced on the new locomotives in 1954.

Powered by a Sheppard Model 16 engine, the new Model SD-4 broadens the range of diesel-powered wheel-type tractors offered in the Sheppard line.

Sheppard Introduces Larger Unit

Latest addition to Sheppard's line of diesel-powered wheel-type tractors is the Model SD-4. Unit design features and specifications are given.

Designed to help the farmer bridge the gap between higher costs and lower prices, the SD4 is said to operate on an average of 1½ gal of diesel fuel per hour.

BACK in 1949, Sheppard entered the farm tractor field with three diesel-powered wheel-type tractors. Up to that time, wheel-type farm tractors were predominantly gasoline-powered.

Now, to further meet the demand for economical farm power, Sheppard has introduced the Model SD-4 tractor which is powered by the Model 16 Sheppard engine. The Model 16 diesel was developed for the primary purpose of powering the SD-4. Of in-line design, the diesel is a 4-cyl unit having a bore and stroke of 4½ in by 5 in respectively.

According to Mr. R. H. Sheppard, president of the company, the new SD-4 has been developed to meet a very real need in today's farm market—the need of farmers for a tractor whose combination of high efficiency, versatility, and low operating cost, would relieve their critical position in the vanishing middle-ground between falling farm prices and rising production costs.

The SD-4 has not been rated in the accustomed manner. Mr. Sheppard points out that it is misleading to rate any tractor by a given number of plow bottoms it will pull in average soil conditions since *average* soil conditions vary widely from one locality to another. It is Sheppard's contention that the only rating of value to a farmer is the actual performance of the tractor on his farm.

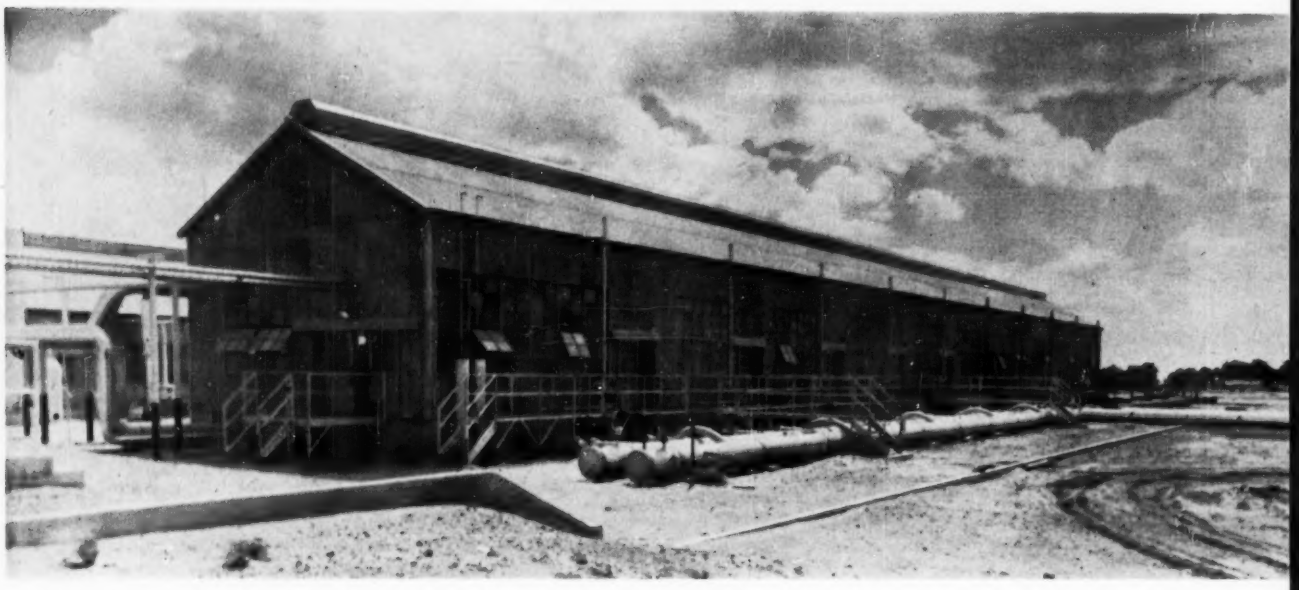
When used year-round on all types of work, the company claims the SD-4 will operate on an average of 1½ gal of low cost furnace fuel oil per hr. The company attributes this to the use of an extremely high 22:1 compressio rate.

Included in the new tractor are a 12-speed transmission, hypoid drive similar to that used in the heavy trucking industry, an independent power take-off unit, and an independent hydraulic system.

Engine Specifications

Sheppard Model 16	Full diesel
Fuel Injection System	Sheppard system
Cylinders	4
Bore	4½ in
Stroke	5 in
Main Bearings	5, tri-metal replaceable steel-backed, shell type
Capacities:	
Lubricating Oil	16 qt
Cooling System	7½ gal
Fuel Tank	22 gal
Cylinder Liners	Removable, wet-type hardened iron
Valves	Overhead, silchrome
Valve Seats	Hardened hi-chrome seats special Sheppard design
Maximum Engine Speeds:	
Full Load	1650 rpm
No Load	1735 rpm
Cooling System	Forced circulation by-pass thermostat
Starting System	Heavy-duty, 12-v electric
Governor	Sheppard fly-ball type approximately 5% regulation
Compression Ratio	22 to 1
Fuel	No. 2 furnace oil or No. 2 diesel fuel
Lubrication System	From full-flow filters. Spray-cooled pistons.

Navajo—the first compressor station on a 423-mile, 24-inch line supplying natural gas to northern California—is powered by 10 Worthington engine-compressors.



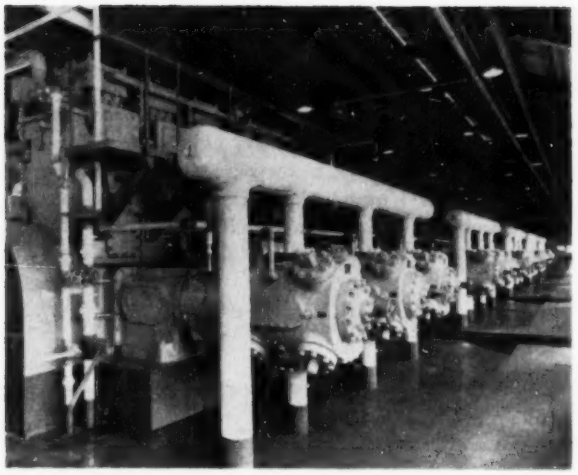
EL PASO Natural Gas Company's Navajo station is moving 167 million cu ft of gas per day. Powered by 10 Worthington angle gas engine-compressors, Navajo was the first station to inaugurate service on this 423-mi line connecting the newly developed San Juan Basin in New Mexico to distribution systems serving northern California.

When current construction is completed, there will be four stations handling 267 million cu ft per day on this line. For more than a year and a half, however, Navajo has worked alone carrying the entire load. The station went into service on September 16, 1951, powered by five Worthington Uniflo UTC-165 gas engine-compressors with a combined rating of 3950 hp at the elevation of 6800 ft.

As the gas field was brought in, the operating schedule for these first five units was increased steadily until they were in virtually continuous service. In January 1953, two of the units ran 100 per cent of the time while two others operated 99 per cent of the time. The result was a plant average of more than 97 per cent. The engines reportedly developed 96.8 per cent of available brake horsepower hours.

By this time, installation of an additional five identical units was in progress, the first two of which were put on the line in February 1953. This expansion will be adequate to handle the projected 267 million cu ft per day. However, this by no means represents the maximum for the company or for the Navajo station.

El Paso has applied for permission to construct new facilities at a cost of more than $175 million to increase main line delivery capacity by another 400 million cu ft



per day. The project will include a new 30-in pipeline from the Permian Basin across the entire state of New Mexico to a point near Gallup, where it will join the 24-in line from the San Juan Basin.

The 30-in line will then parallel the San Juan line westward and connect with the existing 30-in loop at the far western section of the San Juan line.

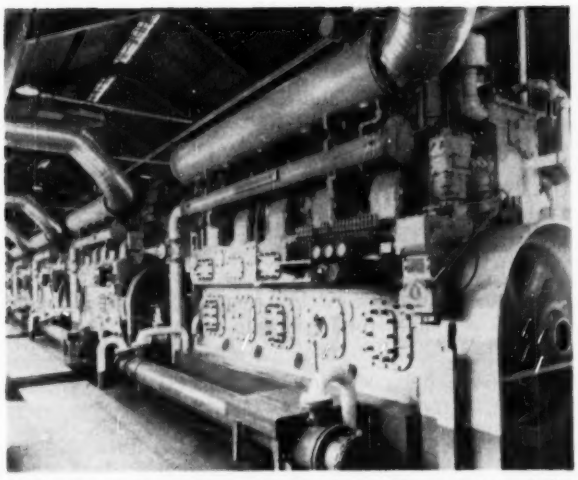
Naturally, this expansion will involve other lines, purification plants, gasoline extraction plants, and increased compressor capacity. Navajo station will get additional, larger engine-compressors which will raise total capacity to 14,000 hp.

Engines and Operation

The greater production envisioned for the future in no way minimizes the man-size job already being done by Navajo station. From the company's San Juan River plant

EL PASO *EXPANDS* SYSTEM

Navajo Station of the El Paso Natural Gas Company, 50 miles deep in the Navajo Indian reservation in Arizona, has been the only compressor station on a 423-mi, 24-in pipeline for more than a year and a half. Compressor Building and suction and discharge headers are shown at far left.



At the top of the page is an interior view of the compressor station showing the ten Worthington Model UTC-165 engines from the compressor side. Directly above, the operating side of the engines are shown. Each engine has been derated to 790-hp to compensate for the altitude.

with its gasoline absorption, purification, dehydration, and compressor facilities, gas moves 138 miles through the 24-in line to Navajo, reaching that station at a gauge pressure of about 500 psi. At this point, gas is compressed and discharged at approximately 845 psi, which is sufficient to move it 285 miles to the delivery point at Topock, Arizona.

Gas enters the station through three suction valves, one to the bypass line and the other two leading to a pair of horizontal scrubbers. Suction and discharge valves are shut off automatically by solenoid-controlled gas cylinders in the event of a drop in gas pressure or a power failure. This emergency shutdown system can also be actuated by a central pushbutton control. The valve that bypasses the station is manually controlled.

A means has been devised for putting oil into the scrubbers while they remain in operation. Oil flows by gravity from a pair of elevated supply tanks into a small header which is connected to the scrubbers by a 2-in line and T-connection. Gas from the station discharge

header is then admitted to the oil header and forces the oil into the scrubbers.

After cleaning in the scrubbers, the incoming gas goes to the suction header and through individual line and valve to each engine-compressor. The Worthington Uniflo UTC-165 has five vertical power cylinders of 16-in bore and 16-in stroke, driving (in this case) three horizontal compressor cylinders of 8½-in bore and 16-in stroke off the same crankshaft. Operating at 320 rpm, this engine has a sea level rating of 1000 hp but is derated to 790 hp at Navajo's 6800-ft altitude.

From the compressors, gas goes to the station's discharge header and then through an induced-draft, dry air cooler before leaving the station through the discharge valves. Gas comes in at a suction temperature of about 48° F, reaches a discharge temperature of about 120° F after compression, and is cooled to around 90° F.

Engine-compressor units use as fuel part of the natural gas they compress. Fuel is tapped from the suction header with one line serving the 10 units and another line to the two engine-generator sets in another building. Engine cooling water is used to heat the gas so that the fuel does not freeze when pressure is reduced for use in the engines.

Double ignition at every power cylinder is provided by a pair of magnetos for each engine. The ready availability of economical natural gas does not lessen the company's interest in fuel economy. In the month of February 1953, with seven units in operation, the engines consumed 30,476 mcf of fuel to compress 4,154,930 mcf, an average of 7.33 cu ft per mcf compressed.

Auxiliaries

An engine-driven gear pump supplies lubricating oil under pressure to all bearings and valve gear, while a force feed lubricator sends oil to the power and compressor cylinders and to the compressor stuffing boxes. Included in the pressure system for each engine is a lube cooler, a full-flow strainer, and a bypass waste-packed filter. Lube oil is also used to cool the pistons.

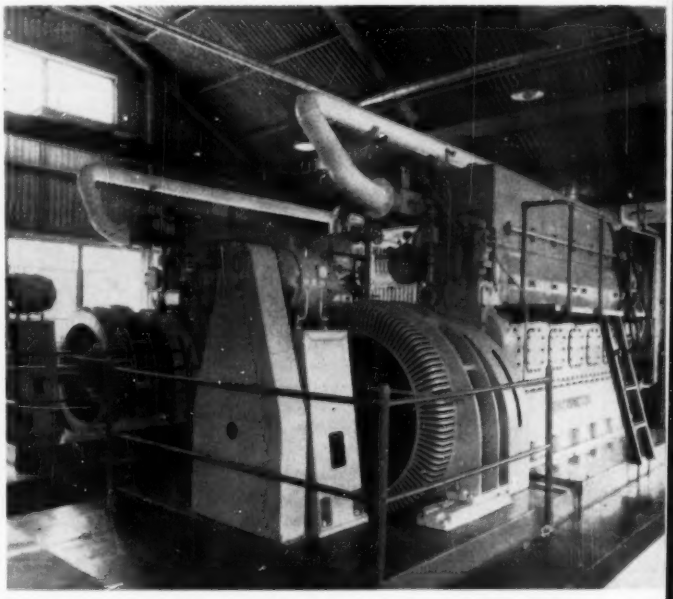
Motor-driven centrifugal pumps, four in all, circulate engine cooling water through the engine jackets and through eight coil sections of a dry-type cooler served by two motor-driven fans. A thermostatically controlled valve bypasses water around the cooler as necessary to maintain desired jacket temperature.

Motor-driven centrifugals circulate water through the lube coolers and four coil sections of the dry cooler which is served by a single fan. All make-up water is treated in a softener before being supplied to the cooling system by a separate make-up pump.

Scavenging air for the 2-cycle engines is drawn through an intake snubber and filter for each unit. Air enters the power cylinder through ports around the entire circumference of the lower end of the cylinder and sweeps the exhaust gasses out through the exhaust valve in the cylinder head. From the exhaust header, the spent gases vent through a vertical snubber outside the plant building.

Electrical Generation

The Navajo station is more or less self-sufficient. Electricity for plant lighting, operation of motor-driven auxiliaries, and domestic use in the homes of operating personnel, is supplied by a pair of CCG6 Worthington gas engines each of which is rated at 353 hp at the 6800-ft



Electricity for the station is provided by this pair of 4-cycle Model CCG-6 Worthington natural gas engines rated at 353-hp each.

elevation. Each engine drives at 450 rpm, a 245-kw synchronous generator with 7.5-kw belt-driven exciter mounted over the outboard bearing.

One engine handles the load easily, with the second providing complete standby protection. The units are alternated in service to give each an equal share of the work. For example, in February 1953, one engine ran 335 hr, the other 337 hr.

Total production was 109,000 kw hr. Fuel consumption was 1428 mcf of natural gas with an engine load that averaged less than 50 per cent of sea level rating. Lubricating oil consumption was low with the engine averaging more than 14,000 rat hp hr per gal of lube.

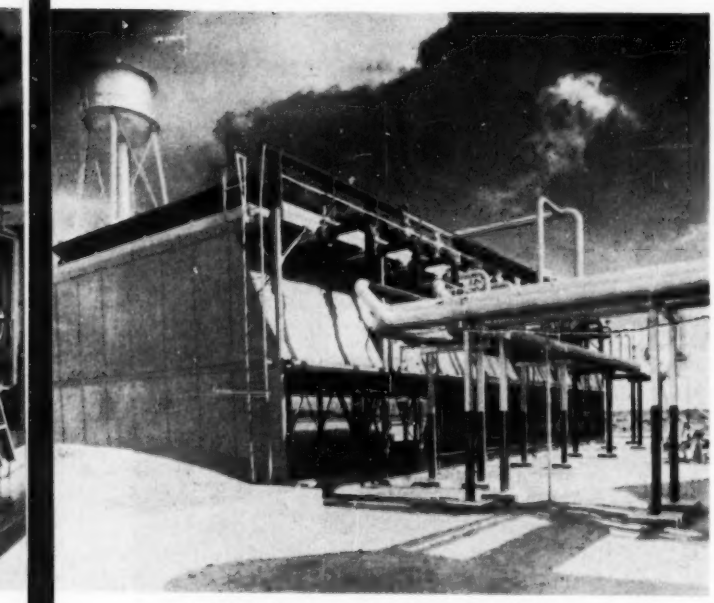
Included in the auxiliary building are a switchboard, a control center for all electrically operated plant auxiliaries and the accessory equipment for the engine-driven-generator sets, the pumps for the plant cooling water system, and three air compressors, two of which are motor-

driven with the third compressor driven by a gas engine.

Under the supervision of R. W. Harris, operations manager of the San Juan division, the Navajo station is operated by Superintendent C. A. Treadwell and Chief Engineer J. F. Donohue. One interesting feature in the operation of this modern, efficient station, is the employment of a number of Navajo Indians on the operating staff.

Summarizing

Navajo station is well into its second year of service, supplying natural gas to numerous municipalities in Arizona and delivering the bulk of its output for use in the San Francisco area. Each of the original engine-compressors already has topped 10,000 hr of operation. But this is just the beginning. The future promises vastly expanded service for an enlarged Navajo station.



This Flour Fin Fan unit cools engine jacket water for all engines in the plant and also the water used to cool the lube oil.

Principal Equipment

Engine-compressors	Worthington Corp.
Valves	Nordstrom Valve
Scrubbers	Stearns-Rogers Mfg. Co.
Gas cooler	Fluor Corp.
Intake filter snubbers	Burgess-Manning Co.
Exhaust snubbers	Burgess-Manning Co.
Lube oil	Shell Oil Co., Inc.
Lube filters	Cuno Engineering Co. Engine Life Products Corp. The Hilliard Corp.
Cylinder lubricators	McCord Corp.
Lube coolers	Kewanee-Ross Corp.
Governors	Woodward Governor Co.
Water cooler	Fluor Corp.
Cooling water pumps	Allis-Chalmers Mfg. Co.
Water softener	Infilco Inc.
Magnetos	Bendix-Scintilla
Exhaust pyrometers	Illinois Testing Labs., Inc.
Engine-generator sets	Worthington Corp.
Generators	Electric Machinery Co.
Switchboard	Westinghouse Electric & Mfg. Co.
Control center	Westinghouse Electric & Mfg. Co.

What Do You Know!

Here are some questions to test your general knowledge of the diesel field. Make your selections, then turn to Page 94 to check them.

1. How's your knowledge of railroad history? The Santa Fe's first Super Chief, powered with its first diesel locomotive, inaugurated service and broke the speed record between Chicago and Los Angeles in—
   a. 1930
   b. 1933
   c. 1936
   d. 1939
2. Gas engine-compressor operation in pipeline service, although substantially continuous, is characterized by relatively low individual engine loading.
   a. True
   b. False
3. Volumetric efficiency improvement and even a degree of supercharging is possible in loop-scavenged 2-cycle engines by which of the following means?
   a. Increasing the scavenging blower pressure
   b. Locating exhaust valves in the cylinder head
   c. Special valving in the exhaust passages
   d. Relocating exhaust ports to close after intake ports
4. Burning of heavy fuel simply entails a system for heating the fuel so as to reduce its viscosity so that it may be pumped more easily both by supply and injection pumps.
   a. True
   b. False
5. Pure distilled water, when used in a closed cooling system, eliminates necessity for cooling water treatment.
   a. True
   b. False
6. Chromate-type materials are widely used for protection of engine cooling water systems. Which of the following characteritics do not apply to these materials?
   a. Do not cause foaming, sludge, or scale
   b. Are compatible with permanent-type antifreeze mixes
   c. Are strong oxidizing agents
   d. Are very low in cost
   e. Give good corrosion protection
7. Combined efficiency of a pre-cleaner and oil-washed air cleaner is often ..... than for air cleaner alone.
   a. Greater
   b. Less
8. With a given size of oil-washed air cleaner, its maximum air capacity is limited to the point where pull-over of oil into the intake system occurs. Which of the following variables do not have a major effect on air capacity?
   a. Oil viscosity
   b. Temperature
   c. Low oil level
   d. Amount of "shake"
   e. Location of inlet
   f. Bends in inlet piping

Reading Exhibits New Equipment

A new instruction car and an F-M Train Master locomotive were recently exhibited to the public at the Reading Terminal in Philadelphia, Pa.

PROUD of its new equipment, the Reading Company featured two new units at its recent public exhibition. The first unit was a new air brake and diesel instruction car which was equipped at the company's Reading shop. The second unit took the form of a 2400-hp F-M Train Master locomotive. Powered by a 12-cyl F-M opposed-piston engine, the Train Master is the largest single-engine locomotive unit to date. It is the first of nine such units to be placed in service on the Reading.

Direct-connected to the engine is the 1660-kw Westinghouse main generator. The generator is reportedly the most powerful single generator ever built for locomotive use. The installation of these nine locomotive units is part of Reading's improvement program in which dieselization of motive power is playing an important part. The nine units also represent an investment in the neighborhood of $2,132,000 which, when figured in terms of cost per horsepower, amounts to less than $100 per horsepower for the complete locomotive.

Indicative of the progress made in this phase of Reading's improvement program is the recent announcement that diesels are performing 95 per cent of the freight service, almost 100 per cent of the passenger service, and 87 per cent of the switching service on the Reading.

Engineman's controls in all but two of the nine new units are installed so that the long end of the locomotive unit is forward. The two exceptions are equipped with dual controls and will be used in passenger service. The dual controls permit operation of the units, with the engineman operating the unit from the right side, in either direction.

The two units equipped with dual controls are assigned to Bethlehem, Pa. One unit makes two round trips daily in passenger service between Bethlehem and Philadelphia, approximately 60 miles one way. The other one is assigned to a 24-hr tour of duty in yard service and will be available as a relief unit protecting passenger service.

Of the other seven units, two will be assigned to heavy yard service at Rutherford, Pa. near Harrisburg; four to colliery service out of St. Clair, Pa. terminal on the 40-mi Mine Hill branch; and one to colliery service out of Tamaqua, Pa.

Instruction Car

The instruction car contains a full set of controls for a modern diesel-electric locomotive, including the electrical devices which regulate flow of current to traction motors. The controls all react as they would in actual operation.

A complete set of air brake actuating parts for freight cars and another set for modern passenger cars, including electro-pneumatic controlled brakes, are also included in the car. Air brake equipment, too, is in operative condition.

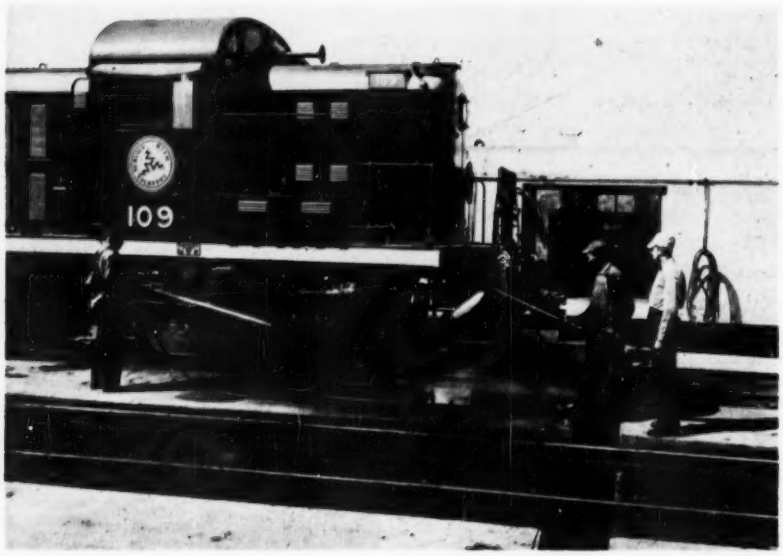
The instruction car, a rebuilt standard passenger car, remodeled and rebuilt from the underframe up, was recently finished and equipped at the company's Reading shop. The car contains a classroom equipped with the latest in audio and visual training aids. It is completely self-sustaining, equipped with a Waukesha diesel Enginator, a fuel oil-burning steam generator, and electric motor-driven air compressor.

F. R. Ellis, Reading Railroad air brake instructor, is in charge of the car which will move to all parts of the railroad for the purpose of instructing locomotive and train crews concerning operation of diesel locomotives and the handling and operation of air brakes. Car will also be used to instruct mechanical department personnel in the maintenance of various types of locomotive and air brake equipment.

Inside the new instruction car, Instructor F. R. Ellis is shown lifting one of the arc shields on a power contactor. Illustrated are most of the electrical devices on high and low voltage panels. Lights, for demonstration only.

A view from the classroom space shows air brake actuating equipment at left, Air brake apparatus and locomotive controls at far end, and electrical equipment at right. The instruction car was rebuilt and equipped by the Reading Company.

DIESEL BRIEFS



Old Baggage Car Houses Cleaning Gear

On the Piedmont and Northern Railway, cleaning equipment is housed in a retired baggage car placed near the locomotive cleaning station. A Model 352 Malsgary, fully automatic, stationary, oil-fired steam cleaner is mounted in the car with hose leads running to the locomotive cleaning station.

Hose leads also run out the back door where air filters, oil filters, engine parts, and maintenance-of-way equipment are cleaned. A steam line for heating a dip tank, in which very dirty filters and parts are placed to soak and soften before steam cleaning, is also provided.

Largest job of this steam cleaner is periodic cleaning of entire locomotives. Engine, engine room, generator room, and under-frame, are cleaned in about three hours. The under-frame is reportedly completed in less than an hour.

F-M to Buy Bearings Co.

A plan to consolidate the Federal-Mogul Corp. with the Bearings Co. of America was announced recently. Directors of the two companies have approved the plan and the proposal will be submitted to a vote of the shareholders of both at special meetings on December 8, 1953. Purchase price is 72,300 shares of Federal-Mogul stock.

Mr. G. S. Peppiatt, president of F-M, stated, "If the stockholders approve the consolidation, and I am hopeful they will, our immediate plans call for operating the Bearings Co. of America as a division of Federal-Mogul. We have long sought an affiliation with a ball bearing producer so we could add that important product to the Federal-Mogul line . . . Combining our two forces should be mutually beneficial."

Instrument Repair Courses

Industrial instruments maintenance and repair courses have been scheduled for the first half of 1954 at Minneapolis - Honeywell Regulator Co.'s Philadelphia training school. The company has been running customers' courses for the past 18 years. This new course, established for the first time last year to include instruction in new devices, will last 14 weeks, from Feb. 15 to May 21.

Uruguay To Be Fully Dieselized

By the end of 1954, Uruguay will be the first country in the world to have a fully dieselized railway system. The country's railway administration announced it has signed a contract for the purchase of 38 U. S.-built locomotives.

The order will bring Uruguay's total to 50 mainline and 14 switching diesel-electric locomotives built by General Electric. Economies in operation costs by use of the new system will substantially aid in wiping out the country's railway deficit, a spokesman for the railways declared.

A&D New Bosch Representative

A&D Diesel Service, Inc., Brooklyn, N. Y., announces it has been appointed by American Bosch Corp. as its authorized sales and service representative for its line of diesel fuel injection equipment.

West Plans Maintenance Show

The West's first plant maintenance show has been scheduled to be held in Los Angeles, July 13-15, 1954, concurrently with a plant maintenance conference. To be modeled after shows which have been held in the East during the past five years, it will underscore the specialized problems of maintenance and engineering faced by western industry which has undergone great expansion since World War II.

According to Clapp & Poliak, Inc., show producers, the newer and better-designed plants of the West are able to employ both operating and maintenance methods not practical in older parts of the country. The show will focus entirely on western specialized problems. "Few companies these days can afford to overlook the tremendous costs of maintenance," it was stated, "and as automatic processes continue to be developed, maintenance will become more and more the primary factor in cost reduction."

DIESEL BRIEFS

English Watertight Tractor

An immersible diesel crawler tractor has been developed by John Fowler & Co., Ltd. of England. The tractor, to meet English Lifeboat Institution requirements, has to haul a lifeboat and carriage, weighing nearly 20 tons, over beaches involving steep gradients and consisting of wet and dry sand, mud and shingle.

One important requirement is the ability to operate continuously at full power when submerged to a depth of several feet. To meet this, the engine is completely encased and the tractor made watertight. Air intake and exhaust ports are fitted with valves which can be clamped down quickly by means of a hand wheel in the driver's compartment.

Locomotive Mileage Up

The Assn. of American Railroads reports that Class I railroads achieved 7.6 per cent more mileage from freight locomotives and 10.7 per more mileage out of passenger locomotives in the first six months of 1953 than they did in the same period of 1952. Better utilization of locomotives is one major factor. This involves the increased use of diesel power with its higher inherent availability.

Shown below are the comparisons.

Road Locomotives	Miles Per Day 1953	1952	Incr.
Serviceable freight	132.3	125.0	5.8%
All freight	100.1	93.0	7.6%
Serviceable passenger	284.5	261.2	8.9%
All passenger	221.0	199.7	10.7%

NACE Sponsors Corrosion Course

The National Assn. of Corrosion Engineers is sponsoring a course in corrosion to be held on the campus of Washington State College, February 1-5, 1954. A brief but intensive review of the fundamental aspects of corrosion, followed by panel discussions and lectures on the application of corrosion control in industry, will be presented. Program includes five general topics: fundamentals, practical aspects, corrosion mitigation, materials of construction, and environment.

Mack LRSW's For Venezuela

Orinoco Mining Co., a subsidiary of the U. S. Steel Corp., will begin operations of mining and hauling out iron ore from Cerro Bolivar, Venezuela, in January 1954. Its property is an isolated mountain containing high grade ore deposits, and Orinoco will bring the myth to reality by "moving the mountain". To aid in accomplishing this herculean task, 16 Model LRSW, 20-cu yd off-highway dump trucks were ordered from the Mack Truck Co. These trucks will carry 35 tons of ore per load, down the mountainside, to a railhead.

Eight of these trucks were shipped in September and eight in October. Each truck is powered by a 300-hp Cummins diesel. To cope with the 8 per cent grades, when running downhill under load, Twin Disc converters and Parkersburg Hydrotarders are included in the special equipment features of these trucks. The order itself was placed with Mack after many months of study and research by both Orinoco and Mack engineers on engineering problems involved.

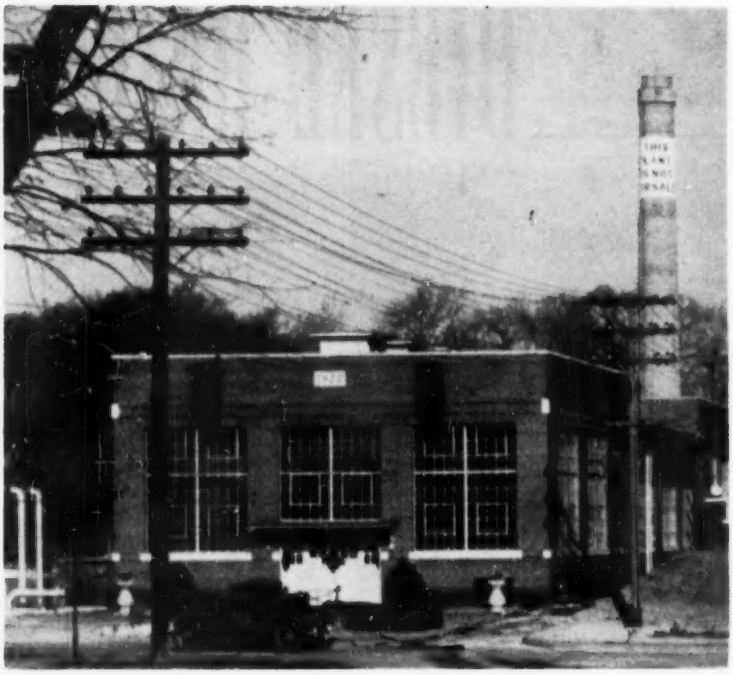
Aluminum Piston Symposium

Over 130 top automotive design engineers were given access to a leading source of piston design information during a recent symposium at the Cleveland, Ohio works of the Aluminum Co. of America. The 2-day symposium presented design information on aluminum pistons developed in over 35 years of research.

B&O Dieselizes Eastern Area

The entire eastern area of the Baltimore & Ohio Railroad, from Jersey City, N. J. to Cumberland, Md., has become completely dieselized for freight and passenger service.

Howard E. Simpson, president of the railroad, disclosed that delivery of eight new diesel passenger units and seven all-purpose diesel locomotives made discontinuance of steam power possible. The road will have 848 diesel units on its line when all diesels on order are delivered.



Responsible for plant operation is Mr. Lafe Pippin, Plant Superintendent.

In an old picture of the plant, we see the community sentiments, with regard to municipal power generation, clearly lettered on the plant stack—This Plant Is Not For Sale.

Neodesha Adds "DuaFuel" Unit

In 1946 we received a letter from the Municipal power plant in Neodesha dated August 12. A portion of this letter read as follows " . . . Over a 19 year operating cycle, the Neodesha Electric Power Plant has interrupted city electric service only five times for a total of 75 minutes." This speaks well of those responsible for plant operation especially since 40 minutes of the 75 were used to change a switchboard during the installation of a new engine—Ed.

NEODESHA, Kansas has been in the power generation business since 1910. It has been supplying its citizens with electrical energy generated by Nordberg diesel and dual-fuel engines for over 30 years. Prior to 1922 the community used steam-driven generating equipment. That year, Neodesha installed two 550-hp Nordberg air-injection diesel engines driving 375-kw generators and abandoned its steam plant. Diesel and dual-fuel engines have generated all the power supplied to the community since the change-over.

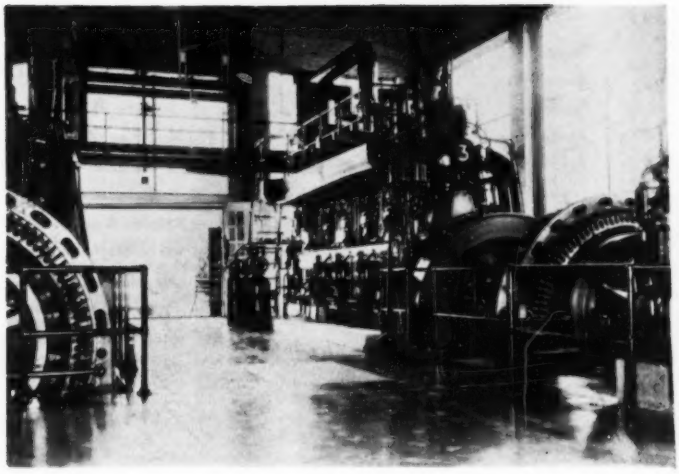
The original 2-engine installation, totalling 1100 hp, served the city until 1934 when an 880-hp Nordberg air-injection unit driving a 600-kw generator was added. Electrical requirements of Neodesha were handled by these three units until 1946 when a 1620-hp air-injection Nordberg diesel was added.

Plant load continued to grow and dictated the installation of still another unit. This engine took the form of a 1750-hp Nordberg 4-cycle, 8-cyl, 327-rmp turbocharged Duafuel unit and was placed in service on January 30, 1952.

Some Figures

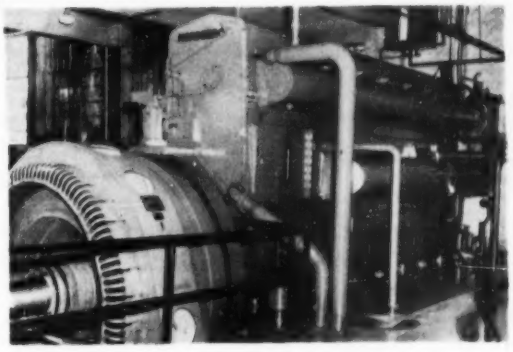
Up to 1948 the Neodesha plant, with air-injection engines, had burned residual fuel oil available from the local refinery. In 1945 the fuel oil cost was 3c per gal. When the average price went to 7.85c in 1947, with gas available at 15c per mcf, the decision was made to convert one unit to dual-fuel operation. The 1620-bhp engine was converted to burn gas in 1948. The effect of this change on the fuel cost per kwh generated is interesting.

In 1946 the plant burned 504,646 gal of oil to generate 5,240,800 kwhr at a fuel cost of 3.34 mills per kwhr. In 1947 the fuel cost using oil had increased to 6.85 mills per kwhr. During 1952 a total of 11,650,600 kwhr were generated using 156,263 gal of oil and 117,865,000 cu ft of natural gas at an average fuel cost of 2.53 mills per kwhr.



One of two such units at the Neodesha municipal plant, this Nordberg is over 30 years old and still going strong.

Below, is an exhaust side view of the 1750-hp Nordberg engine. The intercooler housing is located below the exhaust header.



Plant production costs for the years 1927, 1932, 1942, and 1952 are set forth in Table 2. The low production cost of 4.7 mills per kwhr attained in 1952 is due to a combination of low-cost gas and high load factor realized when supplying the local Standard Oil Company refinery with power while additions were being made to the refinery power plant.

Today all five Nordberg engines that have been installed in the station since 1922 are used in regular operation. As would be expected, the two larger units log more hours operating time than do the three smaller ones, but all are used for power production. For example, during 1952 engine operating hours for the five units were as follows:

Unit No.	*Installed*	*Bhp*	*Operating Hours*
1	1946	1620	7580
2	1934	880	2202.5
3	1922	550	350.5
4	1922	550	288
5	1952	1750	7014

Operating hours for all five units between January 1, 1927 and January 1, 1953 are given in Table 1.

Load Growth

In 1923, the second year diesel engines served as prime movers in the plant, the total generation was 1,400,000 kwhr. During 1952 this plant with an installed capacity of 5,350 hp generated 11,650,600 kwhr. Plant operators will hasten to tell you that the 1952 production was something unusual because the local Standard Oil Company refinery was supplied with electricity during the year while additions were being made in the steam power plant at the refinery. In 1951, for example, the plant generated 5,354,900 kwhr, and the production in 1953 will probably not exceed 6,000,000 kwhr.

The per capita energy production records of this municipal plant during the years it has employed diesels for prime movers again illustrates the tendency for continually increasing use of electricity. Back in 1923, for example, the plant produced about 355 kwhr per capita. By 1930 this figure had increased to 660 kwhr per capita, and in 1940 it was up to 1000 kwhr per capita. In 1950 the production was 1420 kwhr per capita. In spite of the fact that the population of the community has remained relatively stationary for the past 30 years, the demands for electricity continue to increase.

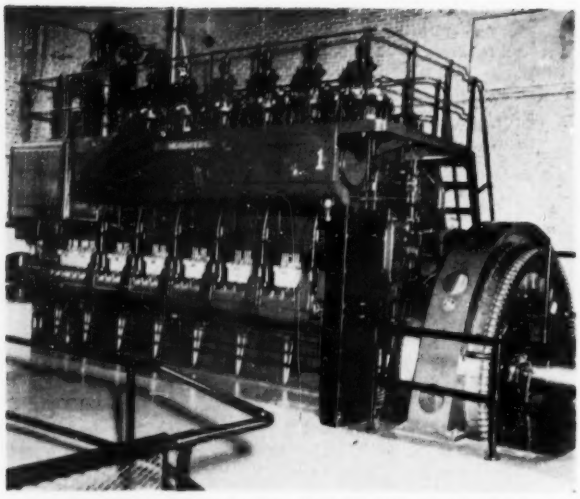
The bulk of the energy generated is sold to residential and small commercial consumers. The power requirements for an alfalfa meal plant adjoining the power plant are very nominal, as are the power demands of the Independent Plow Company, the Missouri Pacific and Frisco railroads, and other small industrial users.

Features of 1952 Installation

Following are some of the important features of this latest engine installation in the Neodesha plant.

The engine is equipped with a gear-driven lubricating-oil pump as well as a motor-driven auxiliary lubricating oil circuit. Cooling of the lubricant is done by a shell-and-tube heat exchanger, with thermostatically-controlled by-pass valve to maintain constant lubricating-oil temperature.

Jacket-water cooling is accomplished by means of a shell-and-tube heat exchanger. A single jacket-water pump supplies the engine. Constant jacket-water temperature is



An operating side view of the 1680-hp Nordberg engine installed in 1946. This unit was converted to dual-fuel operation in 1948.

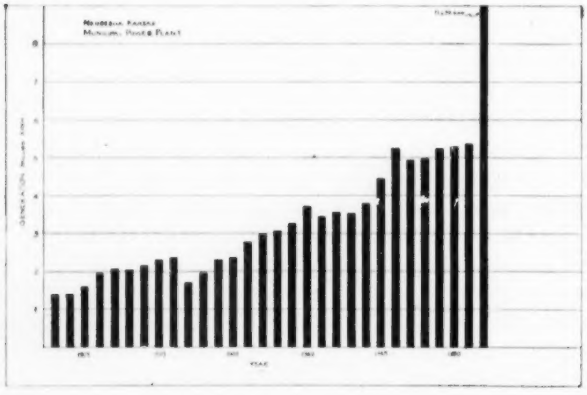
maintained by means of a thermostatically-controlled bypass valve.

Intake air passes through a air filter and a silencer. Exhaust impulses are smoothed out by an exhaust snubber.

In 1949 an addition was made to the power plant building to house modern metal-clad switchgear. This gear, controls five generators, five outgoing feeder circuits, station power and street lighting circuits.

Summarizing

Municipal power generation is "old hat" in Neodesha and the town folk are well aware of its benefits. This implies a good information program to keep the citizens aware of their community asset. Backing this up is an excellent record of supplying reliable, economical electrical power. This in turn is only possible with good supervision and reliable, efficient equipment.



Principle Equipment

Engine	Nordberg Mfg. Co.
Generator	General Electric
Exciter	General Electric
Air-intake Filter	American Air Filter
Air-intake Silencer	Burgess Maning
Exhaust Silencer	Burgess Maning
Shell-and-tube Heat Exchangers	Ross Heater & Mfg. Co.
Lube-oil Strainer	Elliott Company
Auxiliary Lube-oil Pump	Balckmer
Lube-oil Filter	Hilco Type FA 4 Hyflow
Jacket-water Pump	Allis Chalmers Mfg. Co.
Thermostat-controlled Bypass Valves	Powers Regulator Co.
Fuel-oil Filters	Nugent
Supercharger	Elliott Company

Table 1—Summary Of Engine Data

Unit No.	1	2	3	4	5
Date Installed	1946	1934	1922	1922	1952
Bhp	1620	880	550	550	1750
Bore & Stroke	18x25	17x23	15x20	15x20	16x22
Speed, rpm	277	257	225	225	327
Stroke Cycle	2	2	2	2	4
Fuel Injection	air	air	air	air	Mech.
Hours Operated* (To Jan. 1, 1953)	57,349.5	109,694.5	86,869.2*	92,867.1*	7,014

* Data on operating hours for Units 3 and 4 for the years 1922 to 1926 inclusive is not available

Table 2—Plant Operating Costs

Year	1927	1932	1942	1952
Fuel	$ 6,930.24	$ 4,724.38	$10,822.07	$29,424.36
Lube Oil	837.65	890.56	804.67	2,382.05
Labor	7,224.50	6,831.00	9,564.70	15,225.00
Engine Maintenance	4,715.87	314.12	1,168.92	1,586.05
Miscl. Costs	99.62	249.01	1,194.64	6,333.14
Total Operating Cost	19,807.88	13,009.07	23,555.00	54,950.60
Gross Gen, kwhr	2,065,800	1,758,100	3,526,900	11,650,600
Total Opr. Cost Mills/kwhr	9.6	7.4	6.7	4.7

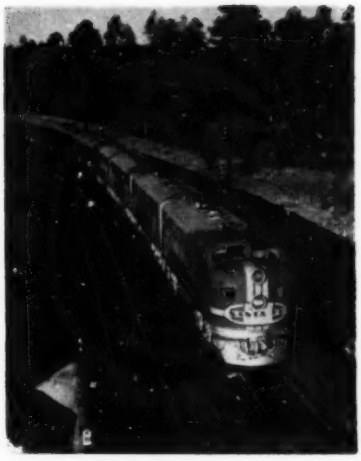
Analysis of Fuel Oil Now Being Used

API Gravity	20-28
Flash	165 F min.
Sulfur	1.5% max.
Water and sediment	1.0% max.
Viscosity at 100F	55 SSU
Conradson carbon	0.5% max.
Heating value	142,000 Btu/gal

Plant Fuel Costs

Year	1943	1944	1945	1946	1947	1948	1949	1950	1951	1952
Fuel oil ¢/gal	3.0	3.03	3.0	4.1	7.85	8.0	6.5	6.87	7.35	7.16
Gas ¢/mcf						15.0	15.0	15.0	15.0	15.47*

*Price of gas increased from 15 to 17c in October, 1953



The Santa Fe's "Super Chief", daily pullman service between Los Angeles and Chicago, shown running through the Coconino National Forest west of Flagstaff, Ariz.

Diesel Power on the Santa Fe

Transition from steam to diesel power on the Santa Fe was a long hard pull as was the case with many other roads. Today, the Santa Fe is rapidly reaching 100 per cent dieselization.

SANTA Fe's first diesel locomotive handled the first Super Chief out of Chicago's Dearborn Station way back on May 12, 1936 at 7:15 pm. Breaking all previous speed records, the train arrived in Los Angeles one minute ahead of schedule—39 hours and 44 minutes later. Thus was Santa Fe's dieselization program officially launched.

Replacing steam power with diesels was not, however, an overnight transition. More than a year before the record-breaking run, a track and signal improvement program was inaugurated. Over 140 miles of new heavier track were installed, numerous curves were straightened and others super-elevated, and many miles of track were reballasted.

In a short year and one-half after the Super Chief's maiden journey, the Santa Fe owned 15 diesel units and progressive-minded management was planning to utilize the advantages and economies of the diesel engine in freight service. In 1940 diesel-operated freight trains were tested. So successful was the diesel operation that the longrange plans for eventual complete dieselization were set in motion.

With the coming of the diesel, a face-lifting of the motive power maintenance operations was evident. The Santa Fe has built facilities which in completeness, resourcefulness, and time and labor-saving innovations, will serve as models for many years. All are capable of expansion to meet expected increases in the fleet. Beginning with Chicago (the first all-diesel railway shop built in America), the Santa Fe has provided the most modern facilities all along its vast system with particularly extensive repairing and servicing plants at Barstow, San Bernardino, Argentine, and Cleburne.

Indicative of the advancement made in diesel maintenance since 1945 when a 6-stall diesel shop was put in operation at Barstow, five stalls have been added, and it has grown into an assembly line procedure capable of completely servicing and dispatching 40 to 42 diesel locomotives every 24 hours.

Above, a view of the service pits 4 and 5 at Santa Fe's Barstow, California Shop. Pits are lit by 25 36-in fluorescent tubes. At left are service men applying traction motor armature bearing grease and crater compound. Engine inspector and journal box oiler are shown at right.

In carrying the dieselization program forward, it was the policy to assign the diesel motive power to territories where the greatest economic advantage could be achieved. By the end of 1952, of the total volume of Santa Fe business, diesels handled 77 per cent of freight gross ton miles, 93 per cent of passenger car miles, and 95 per cent of yard switch locomotive hours.

For the 10 years from 1943 through 1952, the Santa Fe added 1153 diesel units, about one every three days for a 10-year period. By the end of 1953, more than 220 additional diesel units will have been placed in service on the Santa Fe.

It is now contemplated that by the end of 1953 there will remain for dieselization only the through freight service between Argentine, Kansas (Kansas City) and Clovis, New Mexico where the best of the steam engines are in service. Certain other steam engines of an age and size that could make an appreciable contribution to transportation capacity in emergency conditions are being retained as standby power.

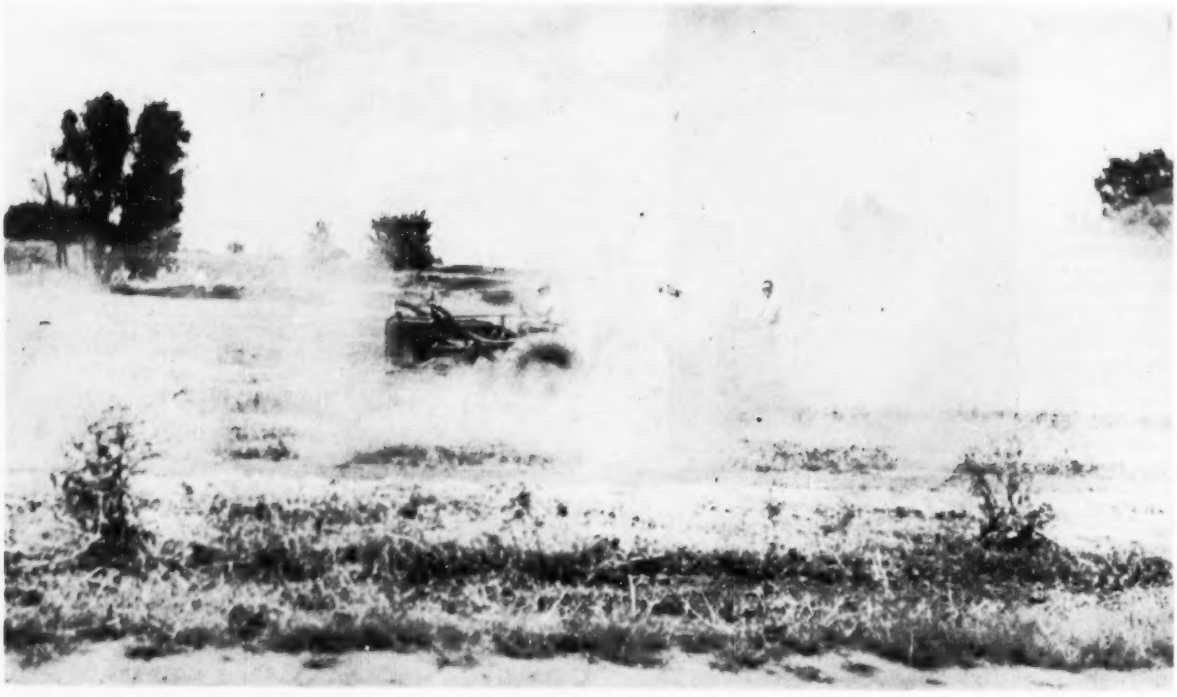


Fig. 1 Illustrates the test equipment in action at John Deere's test farm in Waterloo, Iowa.

Get the Most from Your Air Cleaner

Today's oil-washed air cleaners are very efficient. Are you getting the most out of yours? Proper oil selection, location, and other factors affecting efficiency, discussed here, are things you should know.

By H. M. Turner, Donaldson Company, Inc.

EVERY gallon of diesel fuel burned requires that somewhere in the neighborhood of 12,700 gallons of air pass through the air cleaner. A 60-hp diesel crawler tractor operating for 3000 hours may require its air cleaner to handle easily as much as half the weight of the power unit in dust. Modern air cleaners will cope with this problem and do so with high efficiency if—and the "if" can depend on you—they are given a chance.

The job of the air cleaner is a tough one. As shown, it must handle great volumes of air with no restriction or horsepower loss to the engine. It must remove all types of airborne contaminants with high efficiency. Then, ability to absorb great quantities of this foreign material is necessary for long service life between cleanings.

Construction must be rugged to withstand shaking, vibration, and also service abuse. It must also be capable of operating satisfactorily under temperature extremes ranging from far below zero to 175° F. Finally, the unit must be very small and economical. To appreciate what is being done with respect to size, note the air to fuel ratio mentioned and then compare the sizes of the air cleaner and the fuel filter.

The principles and problems of air cleaning are now pretty well known and the things that are considered unsatisfactory today will be proven minor problems in years to come. Still, we must live with today's problems and there are a few that are of concern to ourselves as well as to the air cleaner users. Two of the most common complaints are that (a) air cleaners are too big, and (b) that they are not efficient. Let's go into some of the factors involved. To clarify the subject under discussion, a functional diagram of modern oil-washed air cleaner is shown.

Influences on Cleaner Size

Operating characteristics within an oil-washed air cleaner will vary with the type of oil used, temperature conditions, and the amount of "shake." Appreciation of these regulating circumstances will help the user to obtain better air cleaner operation and possibly allow the use of a smaller unit for a particular application. Refer to Fig. 3 in which several things are plotted. Notice that the chart is basically an oil viscosity chart plotting Saybolt Universal Seconds versus Temperature.

Along the viscosity lines for the different oils, there are crosses indicating the air capacity in cubic feet per minute of a representative tractor-type air cleaner of the tray design illustrated. Laboratory tests showed that beyond these air capacities, oil pull-over into the intake system occured. The chart is helpful in visualizing the effect on air capacity of the oil viscosity, varied either by oil selection or by temperature conditions. Higher viscosity produces higher air capacity.

Proposed air cleaner oil recommendations were referred to us by a customer for comment. When these were super-imposed on the chart (heavy black lines), it became apparent that by recommending the very thin 50/50 ratio of kerosene and No. 10 oil, he was penalizing his installation. Selection of the low viscosity oil yielded quite varying conditions within the air cleaner and greatly reduced the air capacity at which point pull-over occured. In this installation, quite a bit of shake was expected, so under certain operating conditions, he had limited his safety factor to cope with these conditions.

The dotted lines indicate an alternative proposal which eliminated the use of the low viscosity oils and maintained fairly uniform operating conditions within the air cleaner at any temperature. It also provided a much higher safety factor both as to shake operation and air capacity.

If the customer were able to recommend such oils and be satisfied that they would be used in the field, he could use a smaller air cleaner on the engine.

Field Conditions a Factor

Field operation imposes practical problems such as availability of different oils, operating conditions, and climatic conditions. It is often hard for operators to stock the necessary types and grades of oil. They are also often reluctant to do the work of changing the oil in the air cleaner as atmospheric conditions change.

Day-to-day temperature changes can be important. Take the case of the kerosene and oil mixtures. The viscosity line shown is really only indicative of the mixture right after the products have been blended. When the mixture is put in the air cleaner and the engine started on a cold morning, light ends of the kerosene will pass off. If the day gets warm enough, quite a bit of the kerosene is lost. The remaining oil will be thicker and suited for the higher temperature, but the low oil level will result in lower efficiency and dust-holding capacity.

Carrying this case to extremes, if that night, temperatures go to 15° to 20° below zero, the oil will be too viscous for starting in the morning. To avoid such situations, our tests have shown that the use of Arctic class oils or a good grade of cold weather hydraulic oil, used for equipment controls, is advisable. These hydraulic oils are very satisfactory for air cleaner use in extremely cold conditions and are much to be preferred over the kerosene and oil mixture.

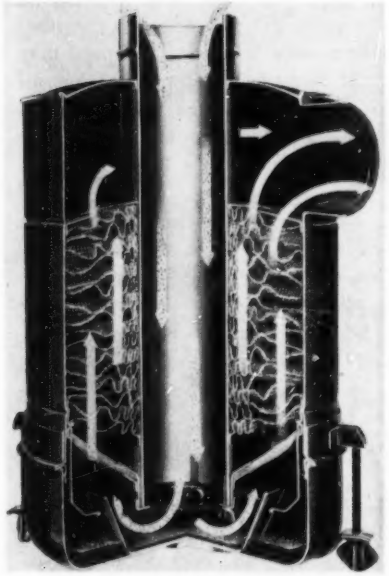


Fig. 2 Functional diagram of an oil washed air cleaner.

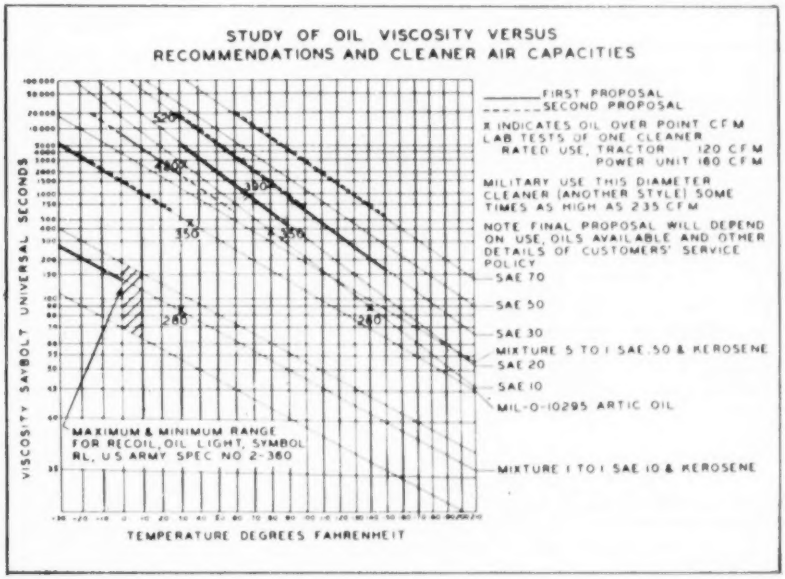
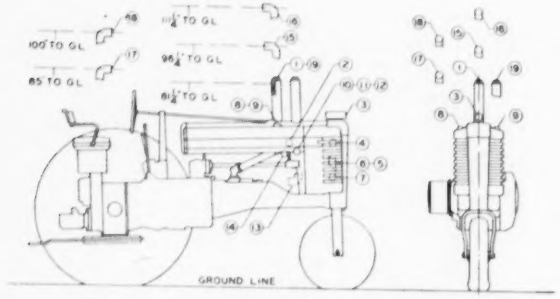

STUDY OF OIL VISCOSITY VERSUS
RECOMMENDATIONS AND CLEANER AIR CAPACITIES
FIRST PROPOSAL
SECOND PROPOSAL
X INDICATES OIL OVER POINT CFM
LAB TESTS OF ONE CLEANER
RATED USE, TRACTOR 120 CFM
POWER UNIT 180 CFM
MILITARY USE THIS DIAMETER CLEANER (ANOTHER STYLE) SOME TIMES AS HIGH AS 235 CFM
NOTE FINAL PROPOSAL WILL DEPEND ON USE, OILS AVAILABLE AND OTHER DETAILS OF CUSTOMERS' SERVICE POLICY
SAE 70
SAE 50
SAE 30
MIXTURE 5 TO 1 SAE 50 & KEROSENE
SAE 20
SAE 10
MIL-O-10295 ARTIC OIL
MIXTURE 1 TO 1 SAE 10 & KEROSENE
MAXIMUM & MINIMUM RANGE FOR RECOIL OIL LIGHT, SYMBOL RL, U.S. ARMY SPEC NO 2-380
VISCOSITY SAYBOLT UNIVERSAL SECONDS
TEMPERATURE DEGREES FAHRENHEIT
500
400
350
300
260

Fig. 3

(Illustrations courtesy of SAE)



1-BASE LINE ON PRODUCTION LOCATION
2-LEFT SIDE FLUSH WITH HOOD
3-AS SHOWN
4-HORIZONTAL TUBE ENDS AND REAR OPEN
5-VERTICAL DUCT REAR OPEN
6-VERTICAL DUCT END MITERED
7-HORIZONTAL TUBE ENDS AND REAR OPEN
8-AS SHOWN
9-AS SHOWN
10-HORIZONTAL TUBE BOTH SIDES OPEN
11-SAME AS 10 EXCEPT LEFT SIDE ONLY OPEN
12-SAME AS 10 EXCEPT RIGHT SIDE ONLY OPEN
13-AS SHOWN ON LEFT SIDE OF TRACTOR
14-BEHIND BAFFLE OPEN AT TRACTOR CENTERLINE
15-AS SHOWN
16-AS SHOWN
17-POSITION OF OPERATOR'S MOUTH WHEN SEATED
18-POSITION OF OPERATOR'S MOUTH WHEN STANDING
19-7 INCHES TO LEFT OF BASE LINE

SUMMARY OF DATA

POSITION	DIRT PICK-UP RATIO[1]	DIRT CONCENTRATION GRAMS/100 CU. FT	TEMP. DIFFERENTIAL DEGREES F.[2]
1	1.000	0.1428	-
2	1.858	0.3834	6
3	1.038	0.1478	-2
4	1.101	0.1366	5
5	1.187	0.1631	8
6	1.604	0.2338	-1
7	5.840	0.3993	2
8	1.984	0.2385	17
9	1.964	0.2847	10
10	3.788	0.4599	32
11	5.643	0.8070	38
12	1.788	0.2095	29
13	3.714	0.3771	37
14	2.980	0.4290	44
15	0.741	0.1384	-2
16	0.844	0.0931	-3
17	1.735	0.2771	0
18	0.944	0.1329	-3
19	0.974	0.1478	0

[1] BASED ON POSITION 1 AS UNITY

[2] TEMPERATURE DIFFERENTIAL TO POSITION 1 AS REFERENCE

Fig. 4 Illustrates the dirt concentration and pick-up ratio at 19 different point along with the temperature differential at these points.

EFFECT OF DUST PARTICLE SIZE ON AIR CLEANER EFFICIENCY

PARTICLE SIZE RANGE MICRONS	AIR CLEANER EFF PER CENT
0- 5	98.45
0-20	97.20
20-80	99.65
40-80	99.98
A.C. FINE BATCH 68	98.48
A.C. COARSE BATCH 540	99.53

A.C. FINE ANALYSIS		A.C.-COARSE ANALYSIS	
0- 5 MICRONS	39±2%	0- 5 MICRONS	12±2%
5-10	18±3	5-10	12±3
10-20	16±3	10-20	14±3
20-40	18±3	20-40	23±3
40-80	9±3	40-80	30±3
		80-200	9±3

NOTE: ALL EFFICIENCY DETERMINATIONS ON I.H.C. UD-9A ENGINE USING STANDARD AIR CLEANER

Fig. 5 Culmination of laboratory tests.

We must also consider operation at elevated temperatures. These might be due to high ambient temperatures or localized conditions where the air cleaner is working. Many recommendations in use today are based on past experience when we were not taking so much horsepower from the same engine blocks as we are today. The heat of fan blasts has gone up considerably, and when the air cleaner is located so as to be subject to this, operation for long periods at temperatures from 140°F to 170°F is not uncommon when the ambient temperature may only be 100°F to 125°F.

The chart shows that such conditions, when using low viscosity oils, cuts down the air capacity safety factor tremendously. Very few operators would normally have heavier oils on hand and they might be reluctant to stock them. Much better results can be obtained by placing the air cleaner and its inlet where it is not subjected to such high temperatures.

Results of two tests will serve to emphasize the effect of temperature on air capacity. These were rocking shake tests with ½-in high oil levels. The oil used had viscosities of 132 SSU and 440 SSU at between 105°F to 110°F, or approximately were the equivalent of SAE Nos. 10 and 30, respectively. The same viscosity change could be achieved in a No. 10 oil with about a 40 deg temperature change. With a constant air volume in both cases, pull-over occured on the fourth shake with the light oil and not until the 25th shake with the heavier of the two.

It can be seen that oil selection from the chart is not as simple as it might appear; other factors must be considered. One thing is very evident however, and that is the advisability of consulting the air cleaner manufacturer before making the original air cleaner installation, and also when selecting suitable oil.

Location Affects Efficiency

Too frequently after proper selection of an air cleaner, it is literally put in the space left over after all the other machine components have been located. The space may be anywhere from front to back and top to bottom of the vehicle. Ideally, it should be located where there is the least dirt for entry. The actual position is generally a compromise and other things must be taken into consideration.

It must be located for ease in servicing. It must not obstruct the operator's view, nor be in the way of accessory equipment. Even the effect on styling is a consideration today. Many of the tests mentioned previously can be made in the laboratory, but it is almost necessary to resort to field tests in order to find the best air inlet placement. In vehicular applications, the tremendous effects of fan blast, wind, and movement of the vehicle on dust concentration to the air cleaner must be considered.

Elevation of the air inlet will result in finer dust particles entering the air cleaner and will usually produce lower dust concentrations. An air inlet location four inches above the hood may yield eight times as much dust to the engine as one 30 inches above the hood. For-

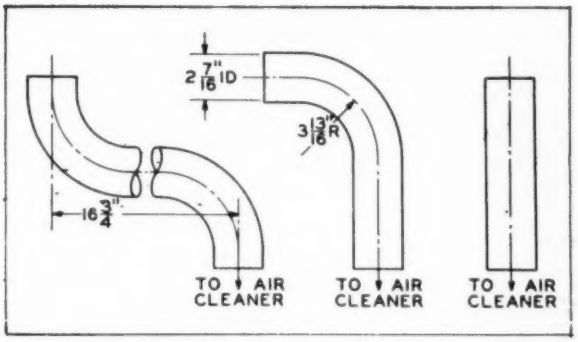


Fig. 6 Effect of inlet elbows on air cleaner efficiency and dust to the engine are shown by the following percentage figures which correspond to the three inlet pipes.

	Left	Center	Right
Relative air cleaner efficiency	99.51	99.66	99.75
Dust to engine Grams/1000 hours	919	638	469

Air flow — 125 cfm
Velocity — 3860 fpm
Dust concentration — .025 grams per cut ft

ward locations also help. Fig. 4 shows the effect of 19 different inlet positions on a wheel-type tractor tested in the Phoenix area. Note also the temperature differences of these locations. These tests were detailed in SAE Paper No. 798, "Advantages of Well-Chosen Air Inlet System" by Mr. Larson of the Donaldson Co.

The shape of the inlet piping may also affect air cleaner performance. In cases where the inlet is remote from the air cleaner, as circumstances sometimes require, the tubing and elbows may cause air cleaner efficiency to drop off considerably. In order to explain this, it is necessary to consider the dust itself.

Fig. 5 indicates the possible effect on air cleaner efficiencies as determined in our laboratories on dust samples furnished through the cooperation of the Engineering Laboratory of Ford Motor Company. These laboratory efficiencies were determined by using floating dust feeders. The A. C. Fine and A. C. Coarse dust indicated our standard dust specifications as used by the air cleaner industry as a whole.

Dust encountered in both the laboratory and the field seldom shows up in the complete division of all particles. They show up as quite large agglomerates. This is of definite advantage to the air cleaner because agglomerates of 0- to 5-micron particles will probably act very much like 20- to 30-micron dust, making the air cleaner's job easier.

Thus, if air cleaner inlet piping or accessories should break down these agglomerates, overall efficiency suffers. Fig. 6 illustrates this by showing the effects of elbows in the induction system. While the efficiencies do not appear to vary much, note the figures in terms of grams of dust to the engine in 1000 hours. These examples are for few and simple bends and it can be appreciated that a poor inlet setup involving many and severe bends will push the high efficiency of modern air cleaners back to the levels of many years ago.

When considering the inlet system, we must also consider the effect of air stack accessories. There are three types to consider: the simple rain hood with very coarse screening action; pre-screeners designed to keep out lint and chaff; and pre-cleaners designed to throw out as much dirt in its dry form as possible. The latter will have the greatest effect on efficiency and though a long established accessory, is a controversial one.

They are installed for two reasons: to lengthen the service life of the air cleaner by removing from 30 to 80 per cent of the dust before it gets to the air cleaner, and for its psychological effect on the operator. He can actually see the dust being removed from the air and is thus more conscious of the necessity for air cleaning and aware that the system is doing some good.

Whether the pre-cleaner should or should not be used is a serious question requiring careful consideration. Fig. 7 shows some field test data indicating the effect of air stack accessories on air cleaner efficiency. All factors in the situation must be weighed carefully, including desired service life, necessary efficiency, type of maintenance planned, and the type of abuse the air cleaner-pre-cleaner combination might have to endure.

A Look at the Future

The future is a projection of the past. Great strides have been made in producing more rugged air cleaners with higher efficiencies and longer service life between cleanings. Careful attention to the foregoing will insure a fuller realization of the capabilities of modern air cleaners. What then is the direction of improvements for the future?

Still greater efficiencies are being sought. Longer service life is expected through higher efficiency pre-cleaners in combination with better air cleaners. Also foreseeable in the future are pre-cleaners requiring no service whatsoever. There is also a possibility that the air cleaner of the near future will not require any oil.

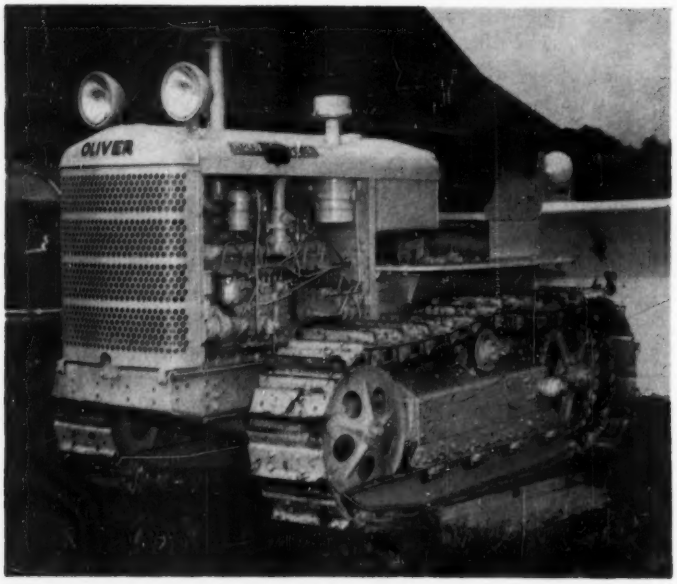
All these things as they materialize should be of benefit to the heavy-duty equipment operator, in view of his increased cost of labor and material, to service and maintain his equipment.

EFFECT OF AIR STACK ACCESSORIES ON AIR CLEANER EFFICIENCY

CLEANER A ALONE	98.72%
CLEANER B ALONE	99.33
CLEANER A + AIR STACK CAP	98.29
CLEANER B + AIR STACK CAP	99.12
CLEANER A + PRE-CLEANER	96.71
CLEANER B + PRE-CLEANER	98.02

NOTE: FIELD DATA ON CRAWLER TRACTOR

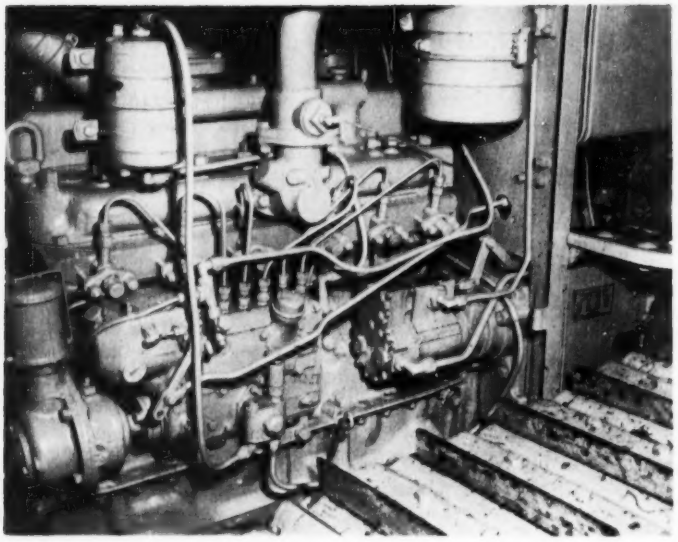
Fig. 7 Field test data



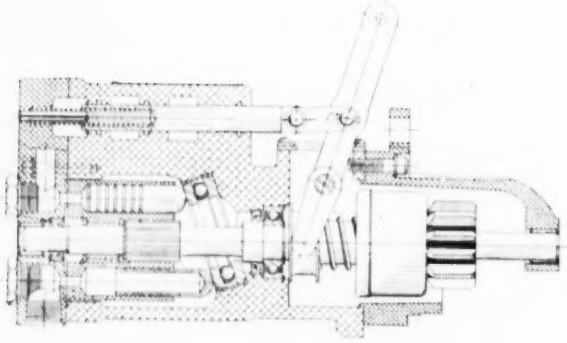
At right, a diesel-powered Oliver tractor equipped with a hydraulic starting motor.

Hydrotor — A Hydraulic Cranking Motor

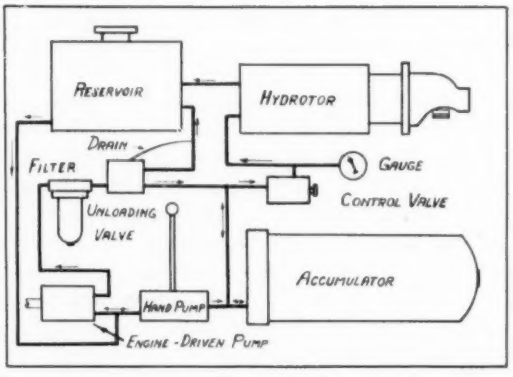
Here is a new approach to the problem of getting adequate cranking speeds so important to diesel engine starting, particularly in cold climates.



A close-up of the tractor shows the location of the Hydrotor.



Typical of the Hydrotor construction is this schematic view of the Model CM2 Hydraulic cranking motor. Actual length is about 7 in.



A schematic piping diagram similar to that used for the Model CM2 Hydrotor, incorporating hand and engine-driven pumps.

"HYDRAULIC" when used as an adjective with "ram", "jack", "press", etc., generally carries the connotation of great power. If such is the case, why not apply it to "cranking" as a means of getting the high torque and cranking speeds so necessary for reliable diesel starting? Such was the thinking of Hydramotive, Inc., of Cleveland, Ohio, that led to the introduction of an integrated hydraulic cranking system.

There are five components of the basic system comprising the Hydrotor or hydraulic cranking motor, a plunger-type control valve, an accumulator where fluid energy is stored, a pressure pump, and a reservoir. By selection of components (for example, there are three motor sizes) and application of suitable pressures, a wide range of cranking torques and speeds are made possible.

Hydrotor Cranking Motors

Although built in three sizes, the principle of operation and general construction is the same in all the units. There is a housing of aluminum construction which accommodates the control valving (in the small size, control valve is separate), and in its central bore, the rotor and drive shaft. The hydraulic pistons are axially located in cylinder bores in the rotor. The piston-end, opposite to the hydraulic pressure, bears on a wabble plate (a ball bearing thrust in the larger units) fixed in the housing.

When fluid enters the inlet port in the housing, it flows through the particular cylinder passage in the rotor that is in index with it. Fluid pressure is then exerted on the piston in that cylinder. The piston, bearing on the inclined plane of the wabble plate, is impelled to slide down it, producing rotary motion. This action, occurring with each piston in turn as its connecting passage lines up with the inlet port in the housing, results in smooth, powerful rotation. As each piston reaches the bottom of its stroke, the pressure is relieved and the fluid discharged.

Cranking power is transmitted to the flywheel ring gear in the conventional ways. In the smaller unit, the inertia-type of pinion engagement is used. In the larger models, preliminary movement of the control valve lever moves the pinion into positive engagement before fluid is applied to the pistons. Here, an over-running clutch is used to prevent the rotor being motored when the engine starts. Standard SAE mountings are used throughout to facilitate adaption to existing engines.

Energy Storage

A piston-type hydro-pneumatic accumulator stores fluid energy under pressure to actuate the motor. The pneumatic side of the piston is pre-charged to 1500 psi with nitrogen. In a test, the charge in an accumulator was retained for three years. Once fluid is supplied in excess of this 1500 psi pressure, it enters the accumulator, moving the piston to compress the nitrogen "cushion" and builds up the pressure in the system.

A manually-operated double-acting pump is used to build up the required volume of fluid to the initial pressure necessary for starting. When frequent starts are anticipated, an engine-driven pump is placed in the system. It is provided with a high-pressure filter and an unloading valve to maintain the maximum pressure desired.

Both pumps take suction from the reservoir. The storage capacity is in excess of the accumulator capacity. Motor discharge and fluid spilled by the unloading valve return to the reservoir where pressures are atmospheric.

Functional Comments

Factory and field tests have indicated that the system will function for long periods with minimum maintenance. In a life test, one unit was started 73,000 times with no apparent wear. Lubrication of the internal parts is, of course, no problem. Inspections and preventive maintenance follow the pattern for other hydraulic systems and present no new or unusual problems. It consists mainly of checking for tightness of all the component parts and interconnections in order to keep the closed system free of any leaks.

	Model CM1	Model CM2	Model CM5
Displacement	1.0 cu in/rev	2.02 cu in/rev	5.4 cu in/rev
Operating pressure	750-3000 psi	1500-3000 psi	1500-3000 psi
Speed range	0-7500 rpm	0-7000 rpm	0-7000 pm
Lock torque			
@ 1500 psi	19.8 lb ft	40 lb ft	106 lb ft
@ 3000 psi	39.4 lb ft	80 lb ft	215 lb ft
Overall vol. efficiency	94 per cent	94 per cent	94 per cent
Approximate weight	12 lb	21 lb	37 lb

The accompanying specifications show the range and flexibility of the units. Cranking speed can be adjusted and torque requirements met to suit the conditions. The constant power characteristics have shown ability to start a big tractor engine in temperatures as low as minus 50° F. Not only do the high cranking speeds that are possible help cylinder warmup and facilitate starting, but they also help to build up engine lubricating oil pressures and thus minimize scuffing and wear.

Emphasizing flexibility, the starting system can also be used for controlled engine jacking for maintenance work such as timing checks, valve adjustment, etc. The starter pinion is held engaged and hydraulic pressure controlled by hand-pump action. This feature is also useful to provide "break-away" torque, prior to attempting starting, to turn over a long-idle engine or one in extremely cold climate.

The Hydrotor cranking system has aroused considerable interest and acceptance. The Oliver Corporation is reportedly planning to make it available on all its models. Simple, compact, rugged, and powerful, the system offers unique advantages and becomes another method of approach to the diesel starting problem.

Cooling System Corrosion Problems

By R. S. Wise

Director of Technical Service, Cooling Water Division, National Aluminate Corporation,

Engine cooling systems should receive adequate protection against corrosion. Some of the considerations involved in the development of suitable corrosion inhibitors and useful pointers are given.

IN 1804 the first steam locomotive was placed in service, but it was not until the turn of the 20th century that much attention was focused on the water treatment problem of the steam locomotive. Even then, 50 years ago, water treatment methods for these units were extremely crude. A similar history, although much more abbreviated, can be shown for the diesel engine.

The first diesel locomotives were put into service in 1925. In 1936 there were 185 units in service. In 1941 the total number of units was 1331, and by 1949 this number had grown to 10,973. These figures are quoted to reflect the increasing acceptance of diesel locomotives for railroad usage. Increased industrial application of diesel engines has paralleled the progress made in the locomotive field.

With this chronology in mind, it is interesting to note that although the first diesel units were used in 1925, the first mention of cooling water treatment for these engines by the American Railway Engineering Association (AREA) appeared in its 1943 proceedings.

In the 1943 report, the committee outlined some of the current practices which included organic treatment of the tannin type, polyphosphate, alkali phosphate, chromium, sodium silicate, pH control, use of distilled water make-up, and soluble oil additives.

None of these were firmly recommended in the AREA report at that time. By 1947 AREA proceedings indicated that the treatment method had swung heavily in the direction of chromate type materials.

In the 1948 report mention is made of a diligent search for chromate substitutes "because chromates are relatively expensive and have been difficult to secure in adequate quantities".

The 1950 proceedings give manufacturers' recommendations for diesel cooling water composition which in all cases are based on the use of chromate type formulations.

The Problem

Railroads have enlisted the attention of the water treatment companies in the diesel cooling problem. Although our discussion is concerned with stationary diesel engines, much of the research on corrosion inhibitors has been made jointly for the locomotive and stationary diesel problems. A number of factors in the general problem are present only in the locomotive part of the picture and yet to those interested in water treatment these factors cannot be omitted from the general picture.

The typical diesel cooling system is not unlike that employed in an ordinary automobile. It functions as a closed system with forced recirculation of water which is cooled by means of a radiator, or in some cases by a shell-and-tube heat exchanger.

Since there is very little evaporation of water, differing thus from a cooling tower or spray pond system, the only requirements for make-up water is to replace water lost through leakage or lost by draining the engine during repair and maintenance operations.

This confines the primary problem to one of corrosion and deposit of corrosion products rather than to a problem of calcareous scale formation. Exceptions to this generalization are the relatively few systems where high make-up water rates exist.

Treatment Requirements

The requirements for treatment of such a system there-

fore is primarily for a good corrosion inhibitor. The specifications for a corrosion inhibitor must include protection to a large variety of metals and other construction materials found in the engines in service. Materials to be protected in diesel cooling systems are as follows:

Steel	Copper	Silver	
Cast Iron	Zinc	Carbon	
Aluminum	Stainless Steel	Buna-type	Synthetic
Brass	Tin	Rubber	
Solder	Lead	Neoprene	

In addition to those above, the treatment should fulfill other requirements. It should not form scale or sludge. It should not induce a foaming tendency in the cooling water. It should be compatible with antifreeze mixtures and effective as a corrosion inhibitor in their presence. It should be chemically stable so that decomposition of the treatment will not impair its effectiveness.

Because of the possibility of cooling water leakage into the lube oil, the treatment should not cause sludge or other harmful effect when mixed with lube oil. The chemical treatment should be nonhazardous to personnel from a handling standpoint. It should be economical. As nearly as possible, the dosage of treatment required should be noncritical and should function equally well at various pH values, temperatures, and dissolved solids content of different waters.

The requirements of objectives as outlined above represent the ideal treatment. We have not yet found that ideal treatment and the question now is just how closely we can approach the ideal.

Chromates

Chromate-type materials have been widely used and have provided a relatively satisfactory answer to the needs of diesel cooling system treatment. They do not cause foaming, sludge, or scale. They have usually met the requirements for corrosion protection of the materials involved. However, the chromate-type materials have not been compatible with ethylene glycol-type antifreeze mixtures and are somewhat harmful to the lube oil. In addition, there is the question of their harmfulness in handling.

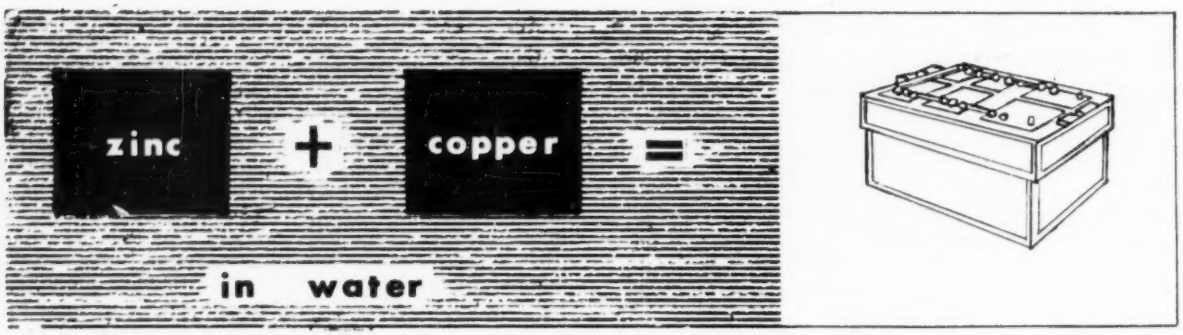
There has been one notable instance in which the chromate-type material did not provide complete corrosion protection in diesel cooling systems. However, the reason for this apparent failure has been both mechanical and chemical. The incident involved was a particular engine design which permitted a high frequency vibration to take place in the cylinder liner.

With this high frequency vibration, a cavitation effect was obtained. Although one solution to the problem was to double the dosage of the chromate-type inhibitor and to raise the pH value of the system water, eventual solution of this problem was a change in engine design.

Since chromates are classed as strong oxidizing agents, they should not be used in the presence of materials that are readily oxidized. It is for this reason that the chromates have not been compatible with ethylene glycol type antifreeze preparations. The expected consequence of mixing chromate with ethylene glycol is that the chromate will be reduced and the ethylene glycol will be oxidized.

This produces deposits of chromic oxide and generates

At left, a cylinder head retainer from a diesel-electric locomotive—ruined by corrosion and pitting. Compare this with cylinder head retainer at right which has seen more than 790,000 miles of service. The retainer at right was protected against corrosion by proper chemical treatment of the engine cooling water.



Any two metals in the electrochemical scale will produce a result similar to that shown above.

acidic materials from the ethylene glycol, thereby impairing not only the effectiveness of the corrosion prevention but also producing deposits and lowering the effectiveness of the antifreeze as well. Compared with some other inorganic corrosion inhibitor salts, chromates are relatively high in cost. In addition, their availability has been questionable in times when chromium has been in heavy demand for metallurgical purposes.

Another disadvantage is that they are toxic in the sense that chromate must be absent from drinking water in order to meet Public Health Service standards. In another sense they are objectionable from the standpoint of causing dermatitis to workers handling them. This latter disability has recently reached serious proportions. This dermatitis is an allergy and as with other allergies not all workers are affected in the same way; in fact, most workers are not affected at all.

Just as with other allergies, however, one cannot tell in advance which people will be strongly affected by a particular irritant, ragweed pollen or chromate, until they are exposed to the particular irritant. Certain precautions can be taken in handling to minimize any ill effects. Chromate-type materials may be supplied in the form of pellets or ball briquettes so that there is a minimum of dust. A very thorough washing of hands and arms after handling these materials is recommended. Wearing clean work clothes is also of definite benefits. There are no indications that when all recommended precautions are taken that workers may be affected by chromate type materials.

Searching for a Substitute

Intermittent shortage of chromate and its potential hazard has given impetus to research programs to develop non-chromate-type corrosion inhibitors for diesel engine cooling systems. The problem has not been an easy one, which again forces our respect for the chromate-type inhibitors. They have been highly effective and not easy to duplicate with other chemical formulations.

Nitrite might be satisfactory for systems which do not contain anything but steel or perhaps even a combination of steel and copper. However, the performance of nitrite in similar water systems has not given uniformly good results. In order to get a general answer to the problem, it is necessary to look further.

Polyphosphates and polyphosphate base materials have received considerable attention as corrosion inhibitors and might well be considered for this purpose. However, the polyphosphates tend to revert to orthophosphates with time and temperature so that polyphosphate addition to a cooling system would result in the material's reversion to orthophosphate probably within less than a week. The treatment would not only lose its effectiveness as a corrosion inhibitor in a week's time but also the orthophosphate formed might combine with hardness present in the water to form phosphate sludge deposits.

We might approach the problem from an entirely different angle and remove all dissolved oxygen from the water by means of catalyzed sodium sulphite. The dosage requirement for sodium sulphite for this purpose would depend upon the amount of air leakage to the system. Some systems would require very little sodium sulphite because of relatively small leakage of air or exposure to air in the system. Other systems would require a prohibitive amount of sodium sulphite for this purpose. Very frequent control testing would be necessary to make sure that adequate sulphite excess was present at all times. There is not a sufficient background of experience to say definitely that even with good control of sulphite excesses that good results would be obtained on systems where dissimilar metals are involved in addition to iron and steel.

On the railroad diesels, the use of aluminum has been quite common and presents a complicating factor to the corrosion prevention job. Protection of aluminum is obtained more easily at pH values below 9. On the other hand, it is a relatively simple matter to protect the cast iron at pH values above 9.

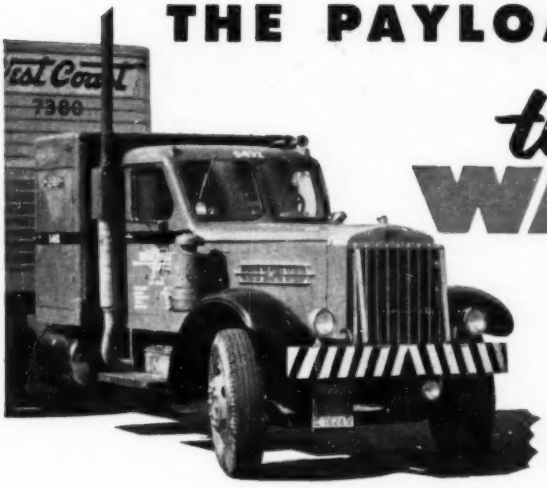
Summarizing

From the foregoing discussion, it may be seen that there are very complex problems involved in developing an inhibitor which will be completely general for all types of diesel engine cooling systems.

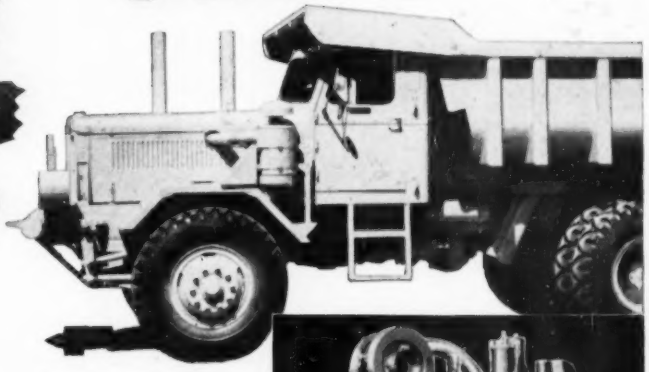
Leading water treatment companies however, have done much research on the subject. Several are now offering non-chromate inhibitors which have recently been successfully field tested and are gaining rapid acceptance by diesel engine users.

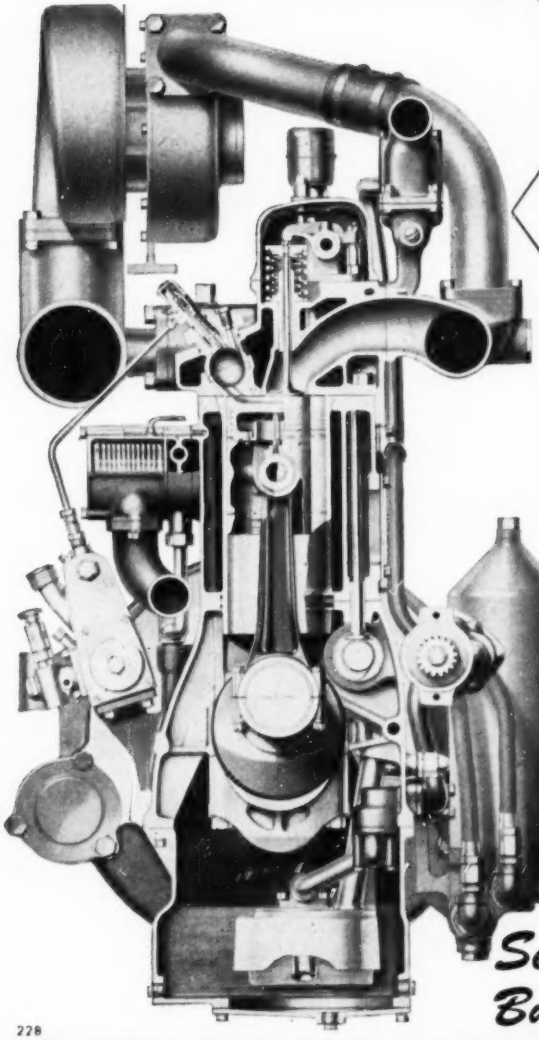
THE PAYLOAD POWER PLANT

turbocharged WAUKESHA *Diesels*

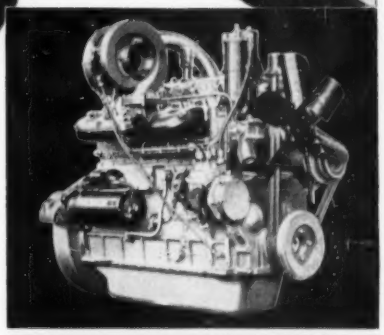


150-352 hp

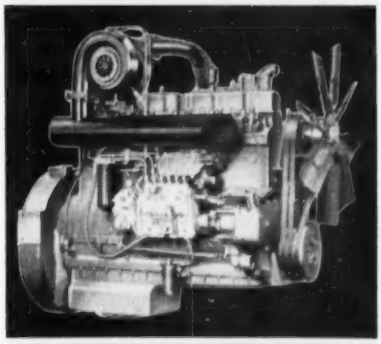




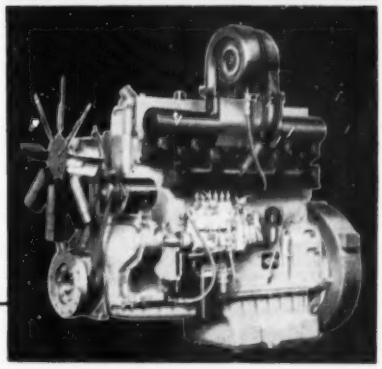
Typical Waukesha Turbocharged Truck Diesel Model 148-DKBS —779 cu. in. Max. hp 280 at 2100 rpm



135-DKBS
—4¼ x 5,
426 displ.,
185 hp



148-DKBS
—5¼ x 6,
779 displ.,
280 hp



WAKDS
—6¼ x 6½,
1197 displ.,
352 hp

Send for Bulletins

228

WAUKESHA MOTOR COMPANY, WAUKESHA, WIS.

New York • Tulsa • Los Angeles

Injector Tube Service Tools

Time and effort required to recondition diesel injection tubes may be drastically reduced by the use of a new diesel injector tube service set just announced by the Kent-Moore Organization, Inc.

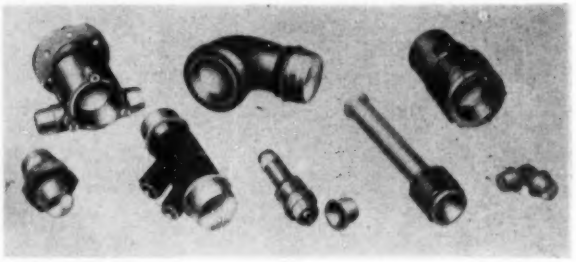
Developed in cooperation with the Detroit Diesel Engine Division of General Motors Corporation and designed especially for use on Series "71" GM diesel engines of 2-, 3-, 4-, and 6-cyl, these new tools not only aid in speeding up the service operation, but give results that closely approximate original factory installation, according to the manufacturer.

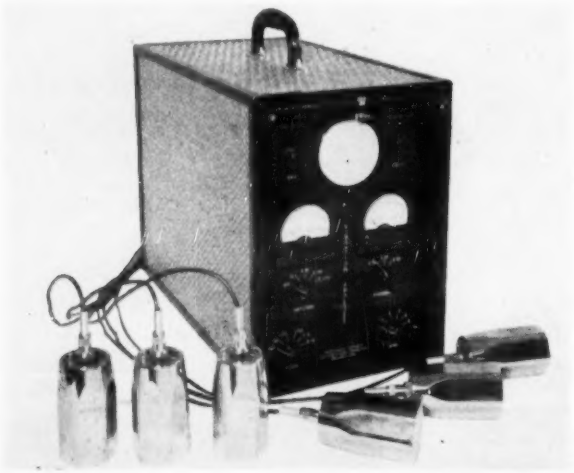
The set includes all the tools necessary for performing the entire injector-tube reconditioning operation, from removal of the old injector tube, through installation, flaring and reaming, to refinishing of the new tube, in accordance with factory recommended procedures. All tools come packed in a sturdy lightweight metal box for convenient on-the-job handling.

Sets may be ordered, or literature concerning it obtained, by writing directly to Kent-Moore Organization, Inc., 5-105 General Motors Building, Detroit 2, Michigan. Price of the set is $107.30, f.o.b. Jackson, Michigan.

Caplugs

Colorful, red Caplugs are finding new uses every day to protect threading, tubing ends, and fittings of all types of products and parts during processing, storage, and transit. They are made of tough, flexible polyethylene plastic and are produced by the Caplugs Division, Protective Closures Company, Inc., 2207 Elmwood Avenue, Buffalo 22, New York.





Vibration Analyzer

Recently announced by the International Research and Development Corporation, the Model 553 vibration analyzer permits selective readings of steady state vibration phenomena from as many as six points on a device or machine under test, and while it is operating under any simulated circumstance of load or speed.

In use, as many as six IRD seismically mounted inductive pick-ups are fastened at the points of stress to be analyzed. A six-position input selector switch permits selective readings from the desired pick-up.

The complete unit weighs 44 pounds, with overall dimensions—9½ in by 13 in by 17 in—making it a portable device for complete vibration analysis. A 4-page folder giving detailed specifications is available from the company at 168 Hosack Street, Columbus, Ohio.

PREVIEW

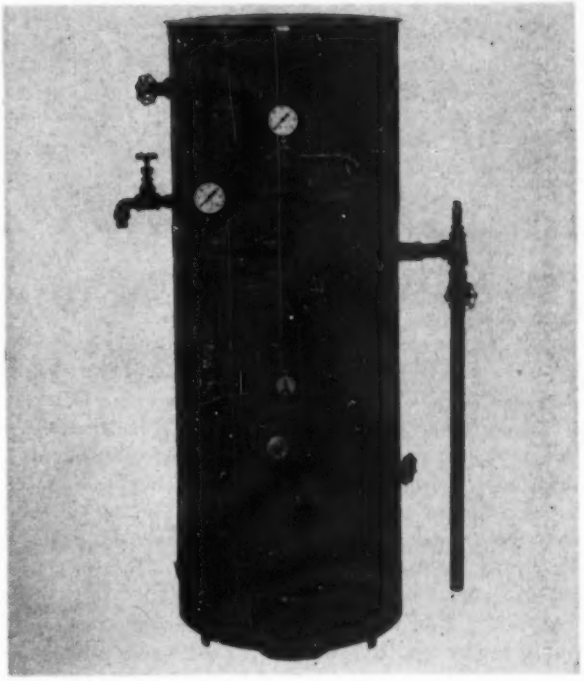
Re-Refiner

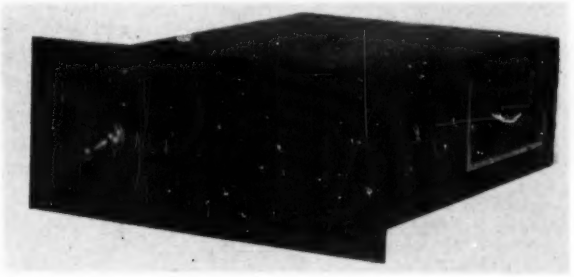
Scot Manufacturing Company is currently offering lubricating oil re-refiners in two sizes, 25-quart and 50-quart capacity. Claimed to recover from 85 to 90 per cent of the used lubricating oil, the company states, it requires only three minutes of labor to start and five minutes to change the filter paper after each batch.

The 25-quart unit will process this amount in approximately one hour at a cost which is reportedly between five and eight cents per gallon. The re-refiners are electrically heated and have no moving parts other than the one electric motor and an agitator shaft.

Designed to render many years of uninterrupted service, the units require little maintenance outside of changing filtering elements at the finish of each batch of lubricating oil which is run through. According to the manufacturer, the re-refining units distill, activate, neutralize, and filter the used lubricating oil, restoring it to a near new quality.

Detailed information and descriptive literature illustrating the units is available on request from the Scot Manufacturing Company, 1412 West Glenoaks Boulevard, Glendale 1, California.





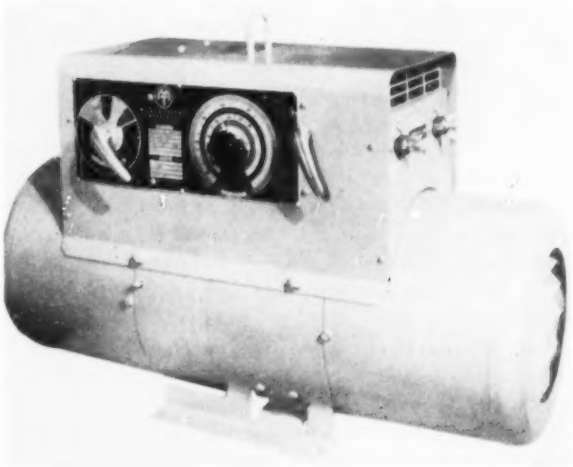
Individual Annunciator

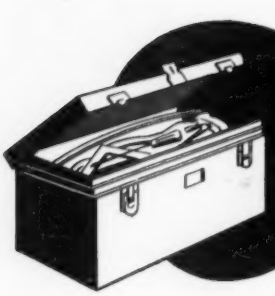
A panel-mounted individual annunciator, designed to replace indicating lights, relays, switches, and nameplates, has been introduced as the Model MLT by the H. R. Kirkland Company of Morristown, New Jersey. Any number of the individual units may be connected to a single audible signal device. Detailed information is available from the manufacturer.

DC Welder

Metal and Thermit Corporation has announced the redesign of its 200-, 300-, and 400-amp DC generator welders. Among the features included in the redesigned units are a one-dial control, convenient current control, and a magnetic motor starter.

The one-dial control is designed to provide close control of the welding current by means of an electrode size selector and a dial for minor current adjustments. Convenient current control, according to the manufacturer, has been made possible by setting the electrode selector to the size of the electrode to be used, then turning the calibrated current dial to the heat desired. A reversing switch provides quick change of polarity. Further information is available from the company at 100 East 42nd Street, New York 17, New York.





Straight from the Tool Box

This is YOUR Department. Pass along your ideas to the other fellow. Send items to the Editor, preferably with a picture or sketch. Contributors will receive $10.00 for each item upon publication.

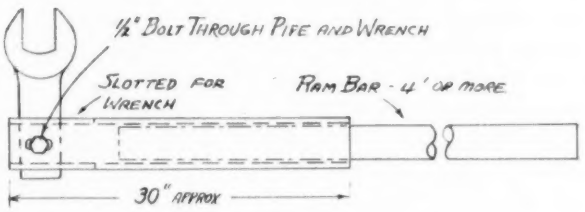
Idea for a "Slam" Wrench

J. H. Graham, Seattle, Washington—I am sending along an idea for a slam wrench that is new so far as I know. I have made them for several different engines and purposes. I found one particularly valuable for main bearing jack bolts of the GM 267A engines.

The open-end wrench used here has a handle short enough to clear the connecting rod next to the bearing on which work is being done. A good heavy-duty wrench is necessary. In some cases, such as when working on the lower main bearing bolts of the Fairbanks-Morse OP, a heavy pattern 6-point box is used in place of the open-end type wrench.

As shown in the sketch, a piece of pipe is pinned to the wrench handle so as to pivot freely. I use 1¼-in pipe. The bar is also 1¼-in diameter and slides nicely in the section of pipe. This pipe is simply a guide for the bar and also helps to hold the wrench in place. No force is transmitted by the pipe or the pin holding it to the wrench. The pipe is slotted on the center line to accommodate the wrench handle, and the pipe bolt holes are also slotted to approximately twice the diameter of the holding bolt.

With one man holding the wrench on the bolt and supporting the weight, another uses the slam bar. It is driven like a pile driver against the wrench handle. Tremendous



force can be developed and delivered right to the wrench.

This arrangement has many advantages. Very little room is necessary to swing the short wrench handle and a wide turning arc is possible with every wrench setting. With the proper wrench size, it can be used for close-coupled generator coupling bolts or in any tight place with no room to swing a double jack. By changing the force used and bar weight, all the force necessary to move the most stubborn nut can be developed.

The ability to apply considerable force right where you want it without the danger of those costly slips is enough to recommend that this idea be given thought. It appears to be a very practical impact tool for heavy-duty and hard-to-get-at wrenching spots—Editor

Formula for Better Operation

Loron White, Briceville, Tennessee—I sure do like the way that you publish your magazine. It tells us a lot of things that we should know and do to keep our equipment out of trouble. I don't have any shop hint or kink to pass along, but I thought that you might be interested in hearing what we think about the best way to keep our earth-moving equipment on the job.

We try to keep the equipment well greased and lubricated, air filters clean, fuel clean, and everything tight. We believe in good tracks, good tires, and good brakes for this equipment. It keeps the machines running better and helps safety. We make sure that machines are greased and oiled whenever they are idle, and also go over them to tighten up any loose bolts and nuts.

We also believe in using the best fuel, engine oil, and grease that can be purchased and that works well in our equipment. We have bulldozers, tractors, shovels, and cranes to keep running and we find that it takes this kind of servicing to have real success with them.

Preventive maintenance; that's the ticket. This may sound like "old hat" to a lot of you fellows, but we wonder how completely you follow these simple precepts. This sort of attention, conscientiously given, will stop a lot of the more serious headaches. Our thanks to Mr. White for his nice comments and for his restatement of basic principles so necessary for successful engine operation—Editor

PRODUCT PREVIEW . . .

U-Type Cleanout Manometers

King Engineering Corp., Ann Arbor, Mich., announces two U-type cleanout manometers for use in measuring pressure, vacuum or differential pressure, in line pressures up to 100 psi.

Model BU has a glass U-tube with packing at the top and is available in 8 sizes from 6-in to 50-in range. Model BS has two straight glass tubes with packing at both ends and a cross connection in lower head, and is available in 13 sizes from 6-in to 100-in range. Tubes are protected at the sides and back by a steel case. Heads are of carbon steel, brass, or stainless steel. Connections are made to upper head and removal of a single screw permits cleaning without disturbing piping.

All-Electric Overspeed Governor

A new governor for overspeed, or under- and over-frequency protection, is all-electric in operation. For mounting, the compact unit needs less space than 6 sq in and in the industrial model weighs under 2 lb. Additional applications include automatic synchronizing, sequence control, circuit-breaker or transfer-switch operation at exact frequency, operation of alarm lights for incorrect frequencies, and similar uses.

Operation is obtained through a frequency reference which may be an alternator (either 60 or 400 cycles), a small tachometer generator, or the ignition breaker points of a gas engine. The frequency-sensing element consists of a tuned vibrating reed driven by an electro-magnet connected to the frequency reference. When the latter resonates with the fundamental mechanical frequency of the reed, it vibrates and closes contact to

A-C Clamp Volt-Ammeter

(Model 633, Type VA-1) For convenient and rapid measurement of a-c voltage and current without breaking the circuit. Jaws take insulated or non-insulated conductors up to 2" diameter. Safe, rugged, versatile. Also available as a-c clamp ammeter, without voltage ranges.

Panel and Switchboard Instruments

A complete line of instruments in all types, sizes and ranges required for switchboard and panel needs... including d-c, a-c power frequencies and radio frequency, rectifier types and D.B. meters.

Specialized and Multi-purpose

INSTRUMENTS

for

- RESEARCH
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For complex, or just routine measurement jobs, these and other specialized WESTON Instruments save time and assure dependable measurements. For information on the complete line, see your local Weston representative, or write . . . WESTON Electrical Instrument Corp., 614 Frelinghuysen Ave., Newark 5, N. J.

WESTON

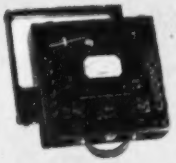
Instruments

Model 622
Ultra-Sensitive Instruments

Portable d-c and a-c thermo instruments for precision measurement of potentials and minute currents in electronics or laboratory research.

Model 697 Volt-Ohm-Milliammeter

One of a line of pocket-size meters, Model 697 combines a selection of a-c and d-c current, and resistance ranges. Ideal for maintenance testing and many inspection requirements.

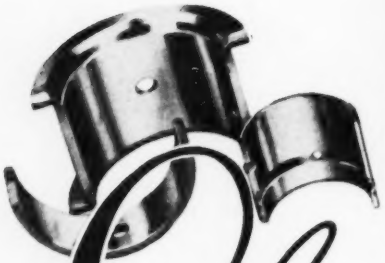


Industrial Circuit Tester – Model 785

A multi-range, multi-purpose, ultra-sensitive analyzer, for laboratory and industrial checking of electrical and electronic circuits. Has 28 practical scale ranges; measures d-c and a-c voltage, d-c and a-c current, and resistance. Accessories available to extend ranges. Compact and portable; furnished in either oak or steel case.

Model 901
Portable Test Instruments

Available in d-c, Model 901 and a-c, Model 904, single and multiple ranges of wide coverage. Excellent scale readability and shielding. Accuracy within ½ of 1%.



The Bearing to match new Diesel power...

Johnson
ALUMINUM-ON-STEEL

This new type sleeve bearing was developed by Johnson Bronze for the newer diesel engines. Heavy duty service, higher loads and high speeds required a new bearing. The properties of aluminum, when bonded to steel, surpass other bearing metals for this purpose. In fact, Johnson Aluminum-on-Steel Bearings give long, trouble-free service at loads up to 5000 P.S.I. They have excellent corrosion and fatigue resistance, good resistance to shaft wear, good conformability and imbeddability and adequate seizure resistance. It is no wonder that they are becoming the preferred bearings in many diesel engines. Write for full information.

JOHNSON BRONZE COMPANY
470 South Mill Street, New Castle, Pa.

JOHNSON BRONZE PRODUCES ALL TYPES OF SLEEVE BEARINGS:

BRONZE-ON-STEEL, copper lead • STEEL BACK, babbitt lined • BRONZE BACK, babbitt lined • CAST BRONZE, plain or graphited • SHEET BRONZE, plain or graphited • CAST ALUMINUM ALLOY • ALUMINUM-ON-STEEL • LEDALOYL powder metallurgy

JOHNSON BEARINGS
Sleeve-Type

pull in a control relay. Energy for reed operation is less than one watt and calibration is to one per cent accuracy.

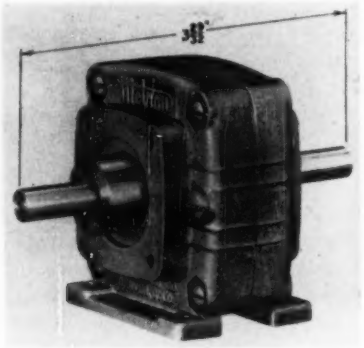
Standard models are furnished with single-pole, double-throw contacts to open or close a circuit as required at the present frequency. With no moving parts except at the instant of operation, long life is indicated. The manufacturer points out that the models are insensitive to vibration, shock, humidity, or altitude. Normally sealed against dust or splash, explosion-proof units are obtainable in hermetically sealed cans. They are manufactured by the Electro Governor Div. of Custom Built Controls, 1801 Rand Rd., Des Plaines, Ill.

Self-Focusing Magnifying Glass

A self-focusing magnifying glass that enlarges reading material to double its size is being manufactured by J. B. Sebrell Corp., 300 S. Los Angeles St., Los Angeles 13, Cal. Rectangular in shape, it rests on the reading matter and permits reader to see a line at a glance. Extruded from transparent plastic into an H-shape, it comes in varying lengths and is lightweight.

Bantam Speed Reducers

Designed to fill the gap between its miniature speed reducers and the larger types, Metron Instrument Co., 432 Lincoln St., Denver 9, Col., is



marketing small speed reducers rated at 1/10 hp and containing 48 pitch gears. The bantam reducers can be used in close quarters, they stand 2 7/16-in high by 2 3/8-in wide and in-line shafts, 5/16-in in diam, make them usable on existing equipment.

Midget Solenoid Valves

Automatic Switch Co., Orange, N. J., has broadened its line of midget 2-way and 3-way solenoid valves to include explosion-proof types, suitable for Class 1 Group D hazardous locations. Solenoid enclosures are of

cast iron with ½-in threaded conduit connections. Conduit boxes can be revolved 360 deg.

The 2-way valves are available normally closed for shut-off, adjustable main flow, and adjustable bypass service; also for normally open shut-off duty. The 3-way valves may be applied to any 3-way requirement regardless of flow direction or points of application of pressure.

Intake-Exhaust Silencers

Two new series of silencers for noise produced by air compressors, blowers, vacuum pumps, and other machines expelling high velocity air to the atmosphere, have been developed by the Burgess-Manning Co., Libertyville, Ill. To be known as Series CA and LCA, they are designed for operation under moisture-free air conditions and for temperatures up to 200°F.

Both series are absorption-type silencers employing straight-through transparent perforated tubes surrounded by a deep layer of special sound-absorbing material with minimum restriction to air flow. Special sound-absorbing material, it is said, can be used for operation at much higher temperature than the standard of 200°F. The CA series is available in pipe sizes up to 6 in. and the LCA series in sizes larger than 6 in. Literature is available on both.

3350 H.P. Drilling Barge Serviced by NUGENT FILTERS

THE "Blind Pass," one of the largest drilling barges in the world, is serviced by Nugent Lubricating Oil Filters. Owned by Richardson & Bass, the rig is powered by five Superior PTDSG-8 super-charged dual fuel Diesel drilling engines delivering a total of 3350 H.P. To protect this power supply, each of the engines is equipped with a Nugent Filter to remove even the smallest dirt and carbon particles from the lubricating oil.

By actual test, Nugent Filters remove 99.8% of harmful impurities that get into lubricating oil. Particles as small as a few microns are removed before they get inside the engine where they would accelerate wear and shorten engine life. This is the kind of filtering that really pays for itself in oil saved, prolonged engine life and dependability.

Nugent oil filters have 20% more filtering area than filters of equal size. Simple piping makes them easy to install. Recharges are inexpensive and easy to replace. Nugent fuel and lubricating oil filters are available in a complete range of sizes and types to meet every demand. Write for full details.

Above: A Nugent Lubrication Oil Filter of the type used on the drilling barge, "Blind Pass."

Wm. W. Nugent & Co., Inc.
417 N. Hermitage Ave. CHICAGO 22, ILLINOIS

OIL FILTERS, OILING AND FILTERING SYSTEMS, TELESCOPIC OILERS, OILING DEVICES, SIGHT FEED VALVES, FLOW INDICATORS

Established 1897

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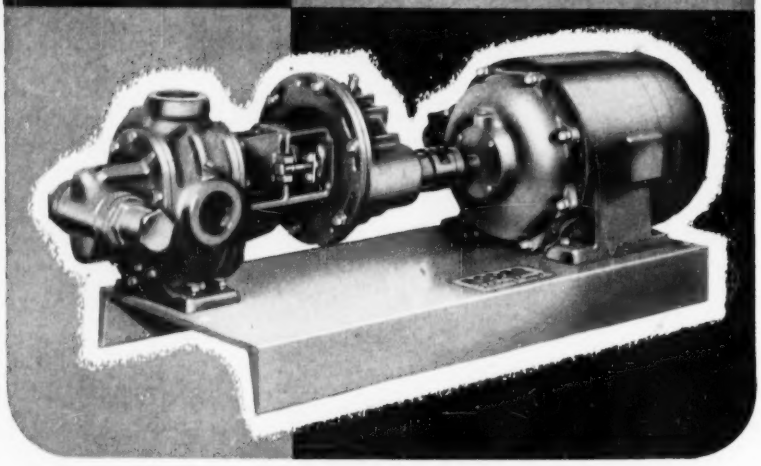
QUALIFIES FOR THE JOB ON MANY COUNTS

ROPER

SERIES 3600

PUMP



If you have a job open for a pump, then by all means consider the Roper Series 3600 as the heart of your fuel transfer system. Designed to handle thin or thick liquids quickly and safely, these pumps offer you the many advantages of the rotary gear principle, plus a most important benefit — Roper *dependability*. There is a size for your needs, as models are available from 40 to 300 G.P.M. sizes — pressures to 60 P.S.I.

Check AND COMPARE THESE FEATURES

- **Compact** . . . requires minimum of installation space.
- **Indoors or Outdoors** . . . no pump house needed.
- **Gear Reduction** . . . totally enclosed and running in oil. Three gear ratios available.
- **Anti-Friction** bearings throughout gear reduction.
- **Steel Bed Plate** provides rigid foundation for pump and motor.
- **Operation** . . . unusually smooth and quiet; pump operates in either direction.
- **Suction Lift** . . . up to 15 feet at 60 P.S.I.
- **Helical Gears** . . . run in axial hydraulic balance. Pump fitted with 4 high-lead bronze bearings; split-type gland.

See Your Roper Distributor or Write for Catalog

GEO. D. ROPER CORPORATION
172 Blackhawk Park Ave.
Rockford, Illinois

ROPER
Rotary Pumps

Casting Repair Plugs

U. S. Plug & Fitting Co., Wellington, Ohio, has developed a line of casting repair plugs, available from 1/16-in to ½-in in either tapered pipe threads or 27 threads ¾ taper per ft, purpose of which is to provide an economical method of repairing and salvaging cast iron castings that would otherwise be scrapped.

The plugs come in three styles,

solid, knock-off, and long. Four steps are recommended for repair:

1. Drill casting for size of plug to be used.
2. Ream hole with a standard pipe reamer having a taper of ¾ in to the foot.
3. Tap hole, using proper tap size for plug size to be used. Depth of hole depends on thread engagement desired.
4. Screw plug into tapped hole; draw up tight. Head portion of plug may be ground or finished off as desired.

Miniature Venturi Tube

Simplex Valve & Meter Co., 68th and Upland Sts., Philadelphia 42, Pa., is introducing type TF venturi tube, a unit designed for the measurement of fluids, gaseous or liquid, in quantities considered too small for the application of a normal size venturi or orifice. This type of tube may be furnished with inlet sizes of ½-, ¾-, 1-, 1¼, 1½-, and 2-in, there being four different ratios of throat to main in each of these sizes.

The tube is intended for installation directly in the pipeline, with no supplemental approach or down stream pipe section provided. Component tube parts are welded together to form an integrated assembly. Annular pressure equalizing rings are furnished at the point where the main and throat taps are located and usually equipped with flanged ends. Screwed ends for sleeve couplings are provided if specified.

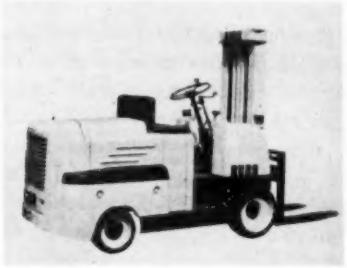
Visual Sequence Annunciator

An annunciator system which automatically indicates the sequence of off-normal alarms has been announced by Panalarm Products, Inc., 6312 N. Broadway, Chicago 40, Ill. Desirable where alarms are applied to closely inter-related variables, the annunciators pinpoint the cause of trouble by indicating the first variable to go off-normal.

This is accomplished either by automatic lock-out of subsequent signals or by causing the first signal to be red and later signals white. The signals are grouped for sequential lock-out by simple jumper connections on the rear terminal block and any number of inter-related groups may be formed or interchanged as desired. A pushbutton reset feature causes the sequence indication to start over again.

Diesel Fork-Lift Truck

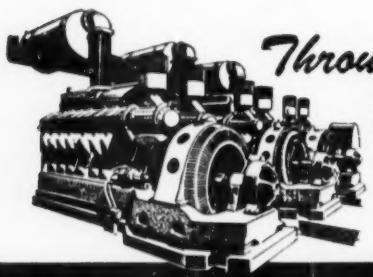
The Buda Co., Harvey, Ill., has announced the development of a 7500-lb capacity fork-lift truck, Model FTD75-25, which is available in all standard lift heights and is powered by a 6BD-230 Buda diesel. Overall length (less forks) is 100½ in with a wheel base of 60 in. Width is 42 in. The unit is so designed that it can turn in a 77¼-in interesting aisle.



All side, rear and top panels are said to be easily removable for quick accessability to parts. The truck is provided with a 12-in diam industrial-type clutch which can be changed in 30 min. Features include a single lever full-range gear shift, center point automotive-type steering, hydraulic brakes, and self-aligning lift cylinder. The unit can be equipped with cushioned or solid rubber tires.

There is a competent Aerofin heat-transfer engineer near you—qualified by intensive training and long experience to find the *right* answer to your own particular heat-exchange problem—and backed by the research and production facilities of the pioneers in light-weight extended surface.

Ask the Aerofin Man.



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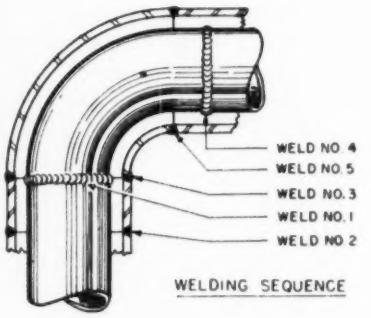
AEROFIN CORPORATION 410 South Geddes St. Syracuse 1, N. Y.

Aerofin is sold only by manufacturers of nationally advertised fan system apparatus. List on request.

New Way to Jacket Fittings

A simple and relatively easy way has been found to employ welded fittings for directional changes in jacketed piping systems, Tube Turns, Inc., 224 E. Broadway, Louisville 1, Ky., announces.

The jacketed fitting combination consists of long and short radius 90-deg elbows, with their center line radii closely matching. On one end of the inside elbow is a tangent that extends beyond the corresponding end of the outside elbow. On the other end of the inside elbow, a short piece of pipe is attached to facilitate the installation work. The welding sequence illustrated must be followed exactly.



WELDING SEQUENCE

This type of jacketed fitting offers important technical advantages and lowers fabrication costs, it is claimed. It eliminates need for coolant jumpers and eliminates flanged joints except where piping must be disassembled. It also permits more accurate temperature control since there are no concentrations of metals to cause overheating or undercooling as when flanges are used. The process minimizes thermal expansion and contraction problems, provides optimum flow conditions since the piping is streamlined, permits insulation to be readily and permanently applied, and is said to sharply reduce maintenance costs.

Molybdenum Disulfide Spray

A new idea in an aerosol-type bomb for spraying a fine mist of submicron particles of molybdenum disulfide over and into friction surfaces, has been announced by Lubri-Mist Co., Inc., Waukesha, Wis. The

spray is available in two types: No. 1 has a volatile carrier giving dry lubrication and No. 2, with a synthetic oil carrier, offers an oily surface.

Feature point of molybdenum disulfide is its claimed lowest coefficient of friction of any commercially available substance. It will not wash off with water, solvents or other chemicals, will not readily wear off, is not affected by high temperatures, and leaves no carbon residue. Quantities are available in 6- and 12-oz sizes.

Triple-Purpose Cleaning Gun

An air pressure gun (75 lb and up), equally versatile for sand blasting, liquid and air cleaning of small parts and surfaces, is being marketed by C. A. Roesch & Co., 1221 S. Hope St., Los Angeles 15, Cal., under the trade name of Carco.

The gun has a metal body with a precision-built valve and trigger assembly and is equipped with a hardened steel jet and nozzle. A complete kit contains the gun, three extra nozzles, extra jet, glass sand container with cap, machined brass fitting, 3-ft rubber hose, and a wrench for removing and installing jet.

Valve and Rotary Gauge Adapter

Break-off accidents and injuries to valves and rotary gauges used on LPG transport tanks are now said to be virtually eliminated by a new forged steel adapter being produced by the S and L Mfg. Co., 1450 W. 174 St., Gardena, Cal. Easy to install, tank fabricators will need only weld the adapter to the pipe being used and then weld the complete unit into the transport tank.

Sheffield to Market Cavitron

The Sheffield Corp., Dayton 1, Ohio, will now design, manufacture, and market Cavitron machine tools, according to a joint announcement issued with Cavitron Corp., Long Island City, N. Y. Both concerns will join in marketing the machines abroad, with Sheffield holding exclusive distribution rights for the United States and Canada. Cavitron will

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BURGESS-MANNING COMPANY

. . . wherever the flow of AIR, STEAM, and other GASES create N-O-I-S-E.

Standard Snubber* designs are available, incorporating Air Cleaning, Spark Arresting, Water Separation, Waste Heat Recovery, and Surge Control Features.

You can depend upon Burgess-Manning Engineers for a quality product . . . and SOUND ENGINEERING counsel to solve your noise problems.

Burgess-Manning Snubbers installed at Corpus Christi, Texas, pumping station.

*Typical Snubber

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continue to produce the ultrasonic transducers and generators, having originated the ultrasonic machining process and holding the basic patent rights, and will license the process through Sheffield.

The Cavitron machine tool has only been on the market a short time. It is a device which utilizes an ultrasonic vibrating head (18,000 to 30,000 cycles per second) and an inexpensive tool (such as soft steel) for the precision cutting of hard and brittle materials (either ferrous or non-ferrous), such as the carbides, germanium, hardened tool steels, sintered aluminum oxide, and other materials difficult to machine. It may be used for extremely precise external or internal machining as well as precision forming of external profiles. Extremely fine surface finish is said to be obtained with no local heating of the work surface or chemical or physical change in the work piece.

FILTERS MAY LOOK ALIKE

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Give the Results Enjoyed by MILLIONS OF SATISFIED USERS THE WORLD OVER

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The Efficiency of LUBER-FINER'S Patented Process HAS NEVER BEEN EQUALLED!

DON'T BE MISLED BY PRICE ALONE!

There is NO substitute for DIESELPAK'S Patented Filtering Process for H. D. Compounded oils AT ANY PRICE. The DIESELPAK cleans more oil faster—keeps it CLEAN longer—and gives more service and better engineered protection than any other filtering element. It PAYS to get the BEST!

✓ PROTECTS ENGINE

The DIESELPAK is designed to remove not only ABRASIVES but also CONTAMINANTS such as moisture, carbon, acid, etc. from oil, and is engineered to keep the filtering media and the removed contaminants from migrating back into engine. The DIESELPAK assures continuous protection that reduces engine wear and maintenance costs far beyond that possible with other types of filter elements.

✓ EXTENDS PERIODS BETWEEN DRAINS

The DIESELPAK collects and holds even the most finely dispersed contaminants without affecting or removing compound additives from the oil. A glance at the dip stick will show that the oil is CLEANER—symbol of better lubrication and longer oil life enjoyed only by Luber-finer users.

✓ TAKES LESS OIL

The DIESELPAK because of its engineered construction requires 2 to 4 quarts less oil than spongy substitute filter elements being offered for use in the Luber-finer housing. This is an additional saving enjoyed when using the DIESELPAK.

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Since Luber-finer was first introduced to the public in 1936, it has gained world-wide acceptance by millions of satisfied users everywhere. Luber-finers are approved by major oil companies and petroleum engineers. Luber-finers are standard or optional equipment on America's foremost stationary engines, diesel trucks, tractors and earth-moving machinery.

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2. DIESELPAK—First made available in 1941, the DIESELPAK was primarily designed for use with H. D. detergent compounded oils under the direction of Dr. Ulric B. Bray, B.S., Ph.D., F.A.I.C., internationally known Petroleum Chemist. The DIESELPAK has also achieved outstanding results when used with fuel oils and straight mineral oils.

GET THE FACTS FREE!

Why take chances with expensive equipment? WRITE TODAY for complete information on what to look for before you buy either Filters or Replacement Packs—see how you can save many dollars and hours in maintenance.

LUBER-FINER, INC., Dept. C-1, 2514 S. Grand Ave., Los Angeles 7

New Literature

Conditioning Diesel Exhaust

The Ruth Co., Denver 2, Colo., has issued a catalog on its MRX gas diesel exhaust conditioners for underground diesel-powered mining equipment. This conditioner is said to remove from 60 to 90 per cent of toxic and noxious gases from diesel exhaust and is also said to remove substantially all of the lubricating oil in the exhaust.

The conditioner exhaust itself is stall and service automotive batteries, with mine air before anyone in the immediate vicinity of the equipment can breathe any part of the exhaust. Process is given in detail with installation and maintenance instructions.

Alumibonding Process

The story of alumibonding, a patented process of molecularly bonding aluminum and its alloys to iron and steel and their alloys, is described in an 8-page booklet issued by Arthur Tickle Engineering Works, 25 Delevan St., Brooklyn 31, N. Y.

Advantages claimed for the process are lightweight and free machinability, corrosion resistance, better thermal conductivity, and good bearing qualities.

A recent application in the diesel field is bi-metallic pistons for large engines. These pistons have a heavy aluminum bearing surface bonded to the full length of the cast iron skirt.

Storage Battery Manual

Publication of an up-to-date storage battery service manual has been announced by the Assn. of American Battery Manufacturers, 2706 First National Tower, Akron, Ohio.

The booklet covers the construction of a battery, how it works, how to maintain battery stock, how to install and service automotive batteries and how to make certain repairs. Definitions of often-used electrical terms and complete index are included.

Although the publication is devoted to automotive batteries, it should prove interesting to industrial battery users. Non-technical language is used. It sells for 30 cents a copy.

Diesel Engine Maintenance

American Locomotive Co., Schenectady 5, N. Y., has published a 145-page manual summarizing a 2-day symposium held this spring on diesel locomotive engine maintainance. Included are 31 individual papers and articles representing the views of 21 participating railroads. The symposium covered such subjects as spectrographic analysis of lubricating oils, filtering and filtering media, cooling water treatment, and railroad applications of the electron microscope.

Among features of the book are more than 50 photographs of various types and qualities of lubricating oils taken through the electron microscope, showing how this new research tool is used as an adjunct to the spectroscope in the analysis of internal-combustion engine lubricating oils and fuels.

Nine papers summarize recent progress in the use of the spectrograph on representative railroads. There are also papers and tables on comparative spectrographic laboratory results, lubricating oil control testing methods, and extensive sections on both oil and air filtering and filter maintenance. A five-page cross-index completes the book. Copies may be obtained from the publications department, Building 143.

High-Frequency Pressure Cells

Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa., has issued an illustrated bulletin presenting utilizations and specifications of its new SR-4 high-frequency pressure cells (Type "HF") in the measurement of rapidly changing pressures up to 20,000 psi.

GE Diesel Locomotives

Two new bulletins have been issued by General Electric Co., Schenectady 5, N. Y.

Bulletin GEA-6009 lists all users of its diesel-electric industrial locomotives outside of the United States and Canada. Sub-divided by locomotive size, listings include user and country, number in service, and year locomotives were purchased. Also included are performance charts and curves for each locomotive size and highlights on diesel-electric switchers.

Bulletin GEA-4657B gives latest information on the company's 70-ton, 600-hp diesel-electric locomotive. The revised bulletin describes overall locomotive performance, power plant, electric drive, equalized swivel trucks, control, and other features. Cutaway views of locomotive and components are included along with case histories. All current owners of the unit are listed.

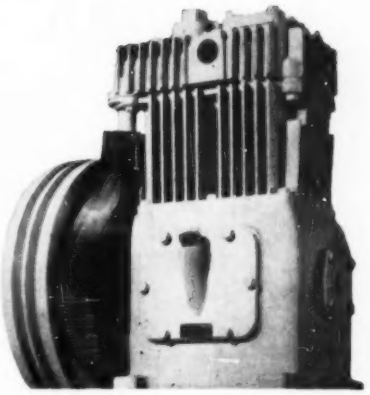
Oil Filtration Catalog

Honan-Crane Corp., Lebanon, Ind., is making available a newly revised catalog describing its complete line of oil and coolant filtration equipment, written in Spanish and French.

The 12-page catalog contains pictures, diagrams, specifications and operating details of filters in addition to cutaway views of four cartridge refills. Catalog is indexed for selection of filter for each oil filtration problem.

You can't fool us! You're an alert businessman who knows the value of dependable compressed air supply. And Quincy Compressors give years of first-class service because they're ruggedly built for long use.

Depend on a Quincy Compressor specialist to help you select the right compressor for your needs. There are modern, compact Quincy Compressors, a variety of mountings... sizes from 1 to 90 c.f.m. You'll see them all in Quincy's complete line catalog. Write Dept. j-34 for your copy.



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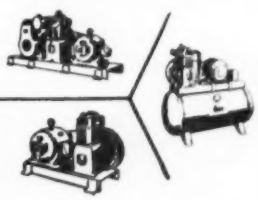

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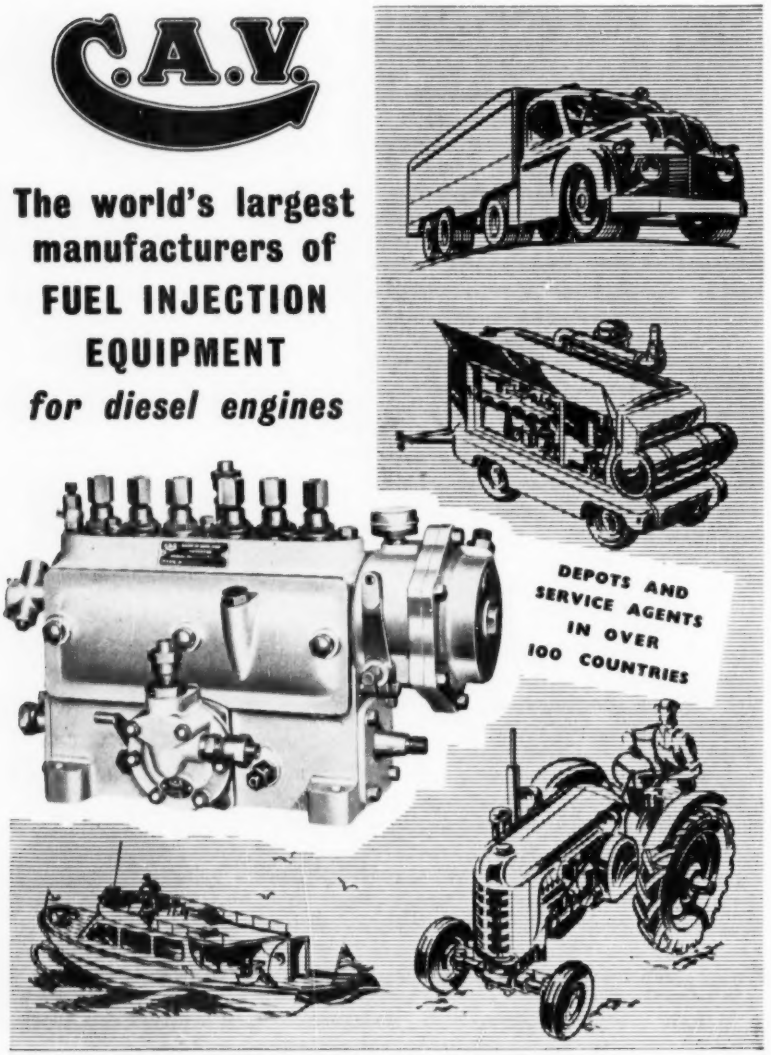
Welding Guide

A 32-page welding guide has been published by Eutectic Welding Alloys Corp., 40-40 172nd St., Flushing, N. Y., giving recommendations for over 300 types of metal joining operations. The booklet is divided into sections dealing with specific base metals. A chart at the end of each section lists electrodes, alloys, and fluxes which may be used on the metals. Illustrations of practical applications are included.

Pyrometer Calibration Data

The Bristol Co., Waterbury, Conn., announces a new issue of its "Pyrometer Thermocouple Calibration Data", based on data recently released by the National Bureau of Standards. The new tables are said to be corrected to the absolute volt and to the International Temperature Scale of 1948. The iron-constantan table has also been corrected to a new curve adopted by the Scientific Apparatus Makers Assn.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174-607

Expansion Joint Design Guide

Engineering application and selection data necessary to the solution of pipeline expansion problems are contained in a 24-page expansion joint catalog released by Flexonics Corp., Maywood, Ill.

Features of the expansion joint guide include a discussion of the various types on the market, design considerations, installation instructions, and selection data. Center spread of the catalog is devoted to a schematic piping layout illustrating various expansion joint applications and principles.

Portable Hoists

Coffing Hoist Co., 300 Walter St., Danville, Ill., has issued a catalog containing illustrations, descriptions, and specifications for its complete line of over 100 types and sizes of portable hoists. Among units described are ratchet lever, spur gear, and electric hoists.

Federal Specifications Guide

Recognizing the complications involved in government specifications for manufacturing, the Navy's Bureau of Ships has concluded what is believed to be the first complete and authoritative guide to the understanding of government specifications, both federal and military. The author of the article, Margaret P. Haskin, writes from 11 years of experience in the Purchase Specifications and Standards branch of the Bureau of Ships.

Covered is information regarding individual specifications and where they may be obtained, how to identify government specifications, where to find a listing of specifications and how to obtain copies, the difference between federal and military specifications, and why other specifications are referenced with a specification.

The article is the first of a series of three; the other two will cover the closely allied subjects of qualified products lists and standards. The article has been selected by the Small Business Administration as a reference for personnel in its regional offices.

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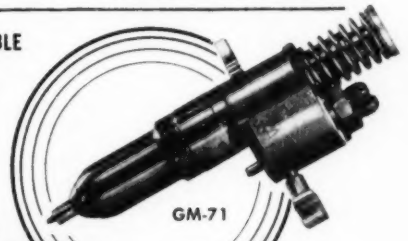

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"You can't beat
S-N MARINE GEARS"

That's what Captain Charles H. Cates, owner of the tug Charles H. Cates VII—which has been in continuous service in Vancouver harbor since September, 1949—thinks about the S-N heavy duty **herringbone** reduction gear and **double cone clutch** that transmits power instantly and simplifies maneuvering. "We do a great deal of harbor work", says Captain Cates, "and I would definitely recommend S-N MARINE GEARS for tugs."

S-N Gears are designed specifically for Marine Engines 4 to 1000 H.P. Wide range of reduction gear ratios available.

S-N Manual — Hydraulic — Air Operated Gears

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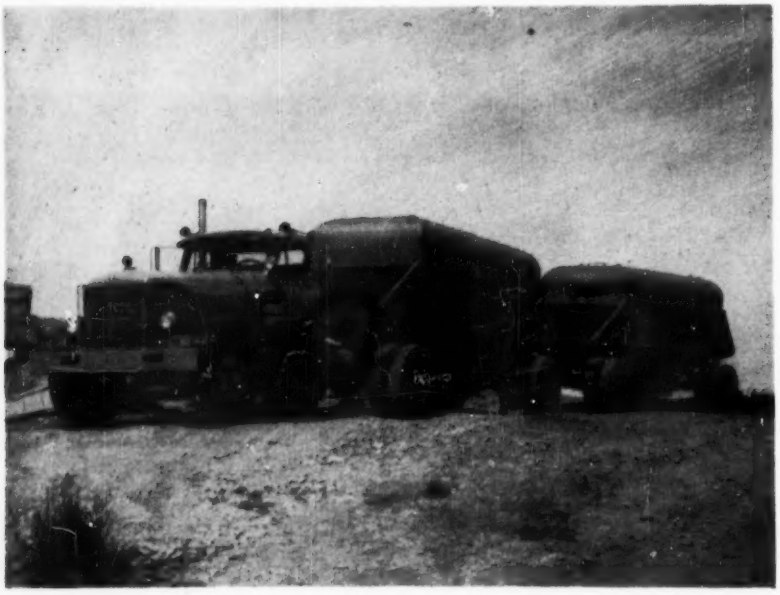
Field Notes



100,000 Miles a Year, Averaging 5.3 MPG

Dan Pack of Pack Truck Lines, Idaho Falls, Idaho, stands in front of his Model LD-405 West Coast International Harvester tractor-trailer which is powered by a Model NHB-600 Cummins diesel.

Dan; his father, Freeman Pack; and his brother-in-law, Merrill Ellswood; each drive similar rigs and haul payloads of 40,000 lb of bulk cement from Idaho Falls to construction projects in the eastern Idaho area. Dan reports that his truck logs nearly 100,000 miles a year and that fuel consumption for the engine averages 5.3 mpg.

Forecast Improved Diesel Fuel

The growing market for high cetane diesel fuels and steps being taken by the oil industry to supply that market were discussed recently by E. A. Desmond of Ethyl Corp.'s research laboratories in an address before the Montreal Section of the Chemical Institute of Canada.

To meet the diesel fuel demand, Mr. Desmond explained, the oil industry has not only had to increase its production of diesel fuels but has also had to concentrate on those fuel characteristics important to diesel engines. One of the most important of these is the fuel's cetane number, which is a measure of its tendency to ignite.

Because of the growth of catalytic cracking facilities, he pointed out, which are primarily for the purpose of making high octane gasoline, the result has been that available diesel stocks have been deficient in some desirable characteristics. However, he indicated, by the use of judicious blending and treatment of diesel fuel base stocks with the required stability additives and ignition improvers, future diesel fuels will be both satisfactory and plentiful.

Back NBS on Battery Additives

Controversy over the National Bureau of Standards' Letter Circular 302, stated substantially that "no material when added to the electrolyte of a lead-acid storage battery would improve its performance or materially reduce the rate of pernicious sulphation", has apparently been settled. The circular brought about an investigation by the Senate Small Business Committee and resulted in Secretary of Commerce Weeks' request for the resignation of NBS Director Astin, a request subsequently rescinded.

The entire matter of the effectiveness of certain battery additives was referred to a committee appointed by Dr. D. W. Bronk, president of the National Academy of Sciences. The committee, headed by Dr. Zay Jeffries, vice president (retired), Chemical Div., General Electric Co., and eight other outstanding scientists, reviewed both sides of the controversy. The quality of the Bureau's work in the field of lead-acid battery testing, together with its findings resulting in the controversial circular, were reviewed. The claims of the opposite side, along with the scientific evidence developed, were also reviewed.

Conclusions reached were that (a) the Bureau's work was excellent, and (b) that the claim of "substantial merit" in behalf of a particular battery additive in the controversy was not substantiated. It was the committee's recommendation that no further tests be instituted by the government as it was felt that the testing had thoroughly covered the ground.

Develop Truck Exhaust Muffler

After two years of engineering research, the General Motors Truck and Coach Div., in cooperation with muffler manufacturers, has developed an exhaust system for its trucks that is said to render exhaust noises inoffensive to the human ear. P. J. Monaghan, vice president of GM and general manager of the division, made the announcement at the American Trucking Assn. convention which had the subject of truck exhaust noises under discussion as one of the truckers' serious public relations problems.

GM truck models with the newly designed mufflers and exhaust pipes are scheduled for production this

month. The name "Silent Power" was applied to the system. No decrease in engine power was necessary to achieve it, and although the system costs more to manufacture it will be standard equipment at no extra cost to the user.

The mufflers are a reverse-flow type, larger than previous units and made more rigid by use of heavier gauges of metal. New exhaust manifolding and larger exhaust pipes are incorporated in the system. A different system had to be developed for each of GM's diesel and gasoline engines because of the different volumes of noise to be muffled.

"It is our hope," Monaghan said, "that other manufacturers will copy our system so that all operators in the trucking industry will eventually benefit from this development. Accordingly, neither GMC nor the muffler manufacturers will attempt to suppress details of the system for competitive reasons".

DEMA Officers Re-Elected

A. W. McKinney, executive vice president of The National Supply Co., was re-elected president of the Diesel Engine Manufacturers Assn. at the annual meeting of the organization in Chicago. This will be Mr. McKinney's second term in office.

New DEMA President

Other officers, also re-elected, were the two vice presidents: Walter A. Rentschler, vice president of Baldwin-Lima-Hamilton Corp.; and William E. Butts, president of Enterprise Engine & Machinery Co. Robert H. Morse, Jr., president, Fairbanks, Morse & Co., was continued as treasurer, and Harvey T. Hill as secretary and executive director.

The following will serve as directors: C. Paul Clark, chairman of the board, Clark Bros. Co.; Guy J. Coffey, president, Chicago Pneumatic Tool Co.; M. C. Davidson, vice president, Ingersoll-Rand Co.; Otto H. Fischer, president, The Union Diesel Engine Co.; Robert E. Friend, president, Nordberg Mfg. Co.; Thomas E. Hughes, general manager, Cleveland Diesel Engine Div. of General Motors Corp.; Gordon Lefebvre, president, The Cooper-Bessemer Corp.; William S. Morris, executive vice president, American Locomotive Co.; and E. J. Schwanhausser, executive vice president, Worthington Corp.

A-C to Continue Buda Operation

The Buda Co., 72-year-old Harvey, Ill. firm recently acquired by Allis-Chalmers Mfg. Co., will operate as "The Buda Co., a division of Allis-Chalmers", according to W. A. Roberts, Allis-Chalmers president, and "will continue to manufacture, distribute, and service all items in its regular line of operations". A more ex-

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You'll never be faced with engine damage caused by oil pressure failure or overheated cooling water IF you equip *your engines* with PENN Safety Controls.

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FOR HEATING, REFRIGERATION, AIR CONDITIONING, GAS APPLIANCES, PUMPS, AIR COMPRESSORS, ENGINES

tensive sales effort in all the businesses in which Buda engaged has been planned.

There are two Buda plants which include more than 25 buildings occupying 654,446 sq ft and covering 28½ acres. Originally established in Buda, Ill., in 1931, the company was moved to Harvey 10 years later.

In 1926, the company turned out its first diesel engine for industrial and construction equipment, and generating sets and power units for various portable and stationary requirements. A complete line of automotive-type diesel engines for trucks was introduced in 1933. Beginning its material handling program in 1938 with the manufacture of small industrial platform-type shop trucks known as Chore Boys, Buda extended this operation in 1948 with the purchase of two firms for the manufacture of fork lift trucks and industrial towing tractors. At present the company builds 22 models of fork lift trucks and seven models of towing tractors. These products are expected to become an important part of its business.

Erie Forge Holds Open House

To herald the opening of its new main office building, Erie Forge & Steel Corp. played host to its employees and their families, throwing open its entire plant for their inspection.

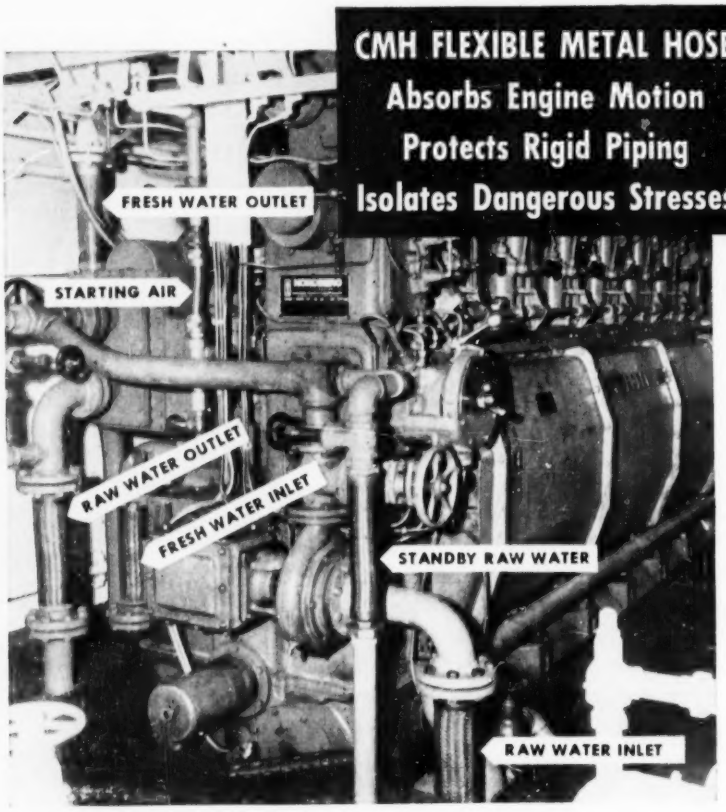
The visitors were taken on a tour which allowed them to see the entire process for the production of crankshafts, forgings, castings, and other vital equipment used in diesel engines and heavy steel machinery.

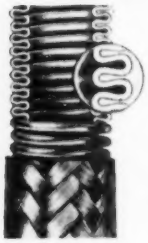
Their first stop was at the 100-ton open hearth furnaces in which pig iron and scrap is melted and processed into carbon and alloy steels. Next, they were taken to the forge department where they observed 12,000-lb steel hammers and giant forging presses where steel ingots are shaped into forgings. The visitors then moved into the huge machine shop which is about 70-ft wide and 1-mi long. Here, they saw the final process where forgings are machined into various intricate items with as fine a precision and finish as the most delicate watch mechanism.

Erie has been in business for 80 years. Since heavy forgings and castings have always been its products, it was never necessary to undertake a big conversion program from peacetime to wartime work. Following the close of World War II, the firm returned to peacetime production without changing tools or equipment. In 1950, when there was a critical shortage of steel, Erie produced steel ingots and shipped them to large steel rolling mills throughout the country to help eliminate the shortage. Its new fire-proof office building represents another step in Erie's growth.

Hague Set for Diesel Congress

The International Internal Combustion Congress has established The Hague, Netherlands as the scene of its third world conference scheduled for May 1955. The topic of discussion has been divided into two categories: (1) Railway applications of





Vital piping connected to the Nordberg marine diesel shown above, is protected with CMH Flexible Metal Hose. The stresses of vibration, expansion and contraction, and misalignment are effectively absorbed by these flexible connections. In existing installations or new ones, it will pay you to eliminate these common causes of piping failure with CMH Flexible Metal Hose. Write for Bulletin 124.

CHICAGO METAL HOSE Division

Flexonics Corporation

1363 S. Third Avenue · Maywood, Illinois

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In Canada: Flexonics Corporation of Canada, Ltd., Brampton, Ontario

Flexon identifies CMH products that have served industry for over 50 years.

CMH

the diesel engine, and (2) Marine and stationary diesel applications.

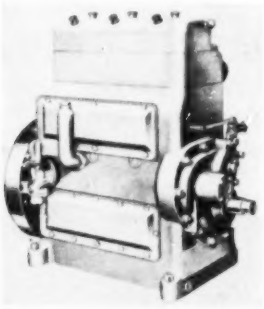
Two American firms participated in this year's conference held in Milan, Italy in May. Socony-Vacuum, under American Society of Mechanical Engineer sponsorship, contributed a paper entitled "Production and Utilization of Residual Fuel". Van der Horst Corp. of America (technically sponsored by the Netherland firm because of its organizational set-up) presented a paper entitled "The Utilization of Heavy Fuel in Diesel Engines with Porous Chrome Plate." Subject of this previous conference was the use of heavy fuels in high and medium power diesel engines.

An invitation has been extended for the submission of papers to the coming conference. Papers may be submitted in either individual's or company's name, to the Secretary of the Permanent Committee, 10 Ave. Hoche, Paris 8, France. The Hague conference is expected to receive maximum attention since it will take place a week in advance of the World Petroleum Congress which is set for Venice, Italy.

B&W to Market Bukh Diesel

Burmeister & Wain American Corp. announces it has acquired an exclusive sales and services franchise for the Bukh diesel engine in the United States, Canada, and Mexico.

The diesels, manufactured by Bukh Motor Works, Ltd., Kalundborg, Denmark, are 4-cycle units, horizontal or vertical, single or twin cylinder, 3 5/32-in bore by 4 11/32-in stroke and 3 15/16-in bore by 5 1/8-in stroke, rated 6 to 30 bhp continuous duty. They are built for land and marine uses in stationary and mobile models. Generating sets are available from 6 to 18 kw, 110 to 220 v DC and 110 to 440 v AC, 50 or 60 cycles, single or 3-phase.



Complete information and descriptive literature on the diesel and its applications may be obtained from B&W, 17 Battery Pl., New York 4, N. Y.

API Meets, Claims Oil Record

At the recent annual meeting of the American Petroleum Institute, an optimistic forecast of the future in the domestic oil industry was presented by John R. Suman, vice president, Standard Oil Co. (New Jersey). He stated that despite production cutbacks in several months this year, domestic crude oil production will average about 4 per cent above 1952, itself a record year.

Dealing with the importation of foreign oil, he said that the "story is definitely not one of floods or torrents . . . Bureau of Mines' figures show that the ratio of crude imports to domestic crude production was

It pays to ask that question every time you purchase diesel-powered equipment because the Lanova Combustion System:

- Provides a more economical and effective method of converting raw fuel into useful power.
- Promotes higher combustion efficiencies by thoroughly mixing the fuel with the air needed to support combustion.
- Isolates jarring peak combustion pressures in the Lanova energy cell—feeding them back to the cylinder in the form of smooth, controlled working pressures which are applied to the piston over a full degree of the power stroke.

For the modern, high speed diesel, there's no finer combustion system.

SEND FOR THE INSIDE STORY OF DIESEL ENGINE COMBUSTION

The 58-page Lanova Handbook provides a simple clear-cut explanation of the importance of combustion in the modern high-speed Diesel. Write for a free copy.

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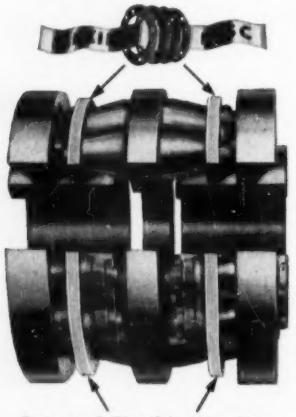
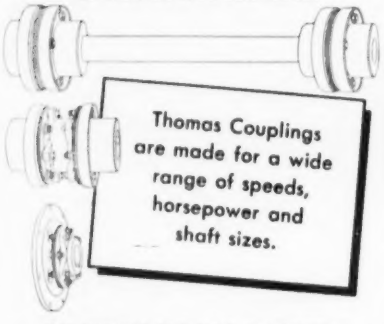
One of America's foremost names in diesel research and development

Specify **THOMAS** ALL METAL
FLEXIBLE COUPLINGS
for Power Transmission to avoid Costly Shut-Downs

DISTINCTIVE ADVANTAGES	
FACTS	EXPLANATION
NO MAINTENANCE	Requires No Attention. Visual Inspection While Operating.
NO LUBRICATION	No Wearing Parts. Freedom from Shut-downs.
NO BACKLASH	No Loose Parts. All Parts Solidly Bolted.
CAN NOT "CREATE" THRUST	Free End Float under Load and Misalignment. No Rubbing Action to cause Axial Movement.
PERMANENT TORSIONAL CHARACTERISTICS	Drives Like a Solid Coupling. Elastic Constant Does Not Change. Original Balance is Maintained.



Patented Flexible Disc Rings of special steel transmit the power and provide for parallel and angular misalignment as well as free end float.



Thomas Couplings are made for a wide range of speeds, horsepower and shaft sizes.

THE THOMAS PRINCIPLE GUARANTEES PERFECT BALANCE UNDER ALL CONDITIONS OF MISALIGNMENT

NO MAINTENANCE PROBLEMS

ALL PARTS ARE SOLIDLY BOLTED TOGETHER

Write for our new Engineering Catalog No. 51

THOMAS FLEXIBLE COUPLING CO.
WARREN, PENNSYLVANIA, U.S.A.

10.8 per cent in 1950. In 1951, due to the abrupt shutdown in Iran, the ratio fell to 9.3 per cent; last year it went up to 10.2 per cent; and this year, the way imports are running, it looks as though the ratio will be about 10.3 per cent."

In another address, Warren L. Baker, editor of *World Oil*, said there must be tremendous future discoveries of petroleum and natural gas to meet demands; it will be necessary to discover an average of 4 billion barrels of new oil annually by 1955 and 4 2/3 billion barrels by 1960.

He declared that prospective increases in natural gas consumption will be too large to depend on accidental discoveries made while searching for oil. Placing natural gas production at eight and four trillion cubic feet, he said that there are some forecasts that 1975 consumption will require a producing rate of 2½ times that of 1952.

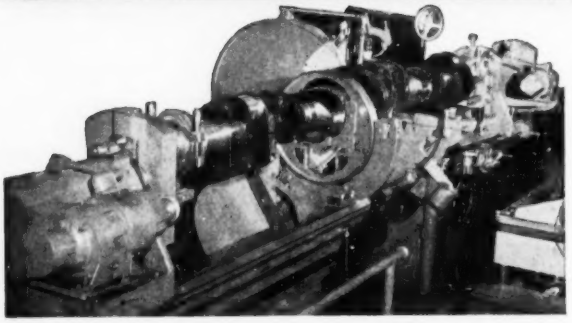
P. C. Spencer, president of Sinclair Oil Corp., was elected chairman of the board of directors of the Institute to succeed L. S. Westcoat, president of The Pure Oil Co. Frank M. Porter, president of Fain-Porter Drilling Co., was re-elected president.

ASA Presents Standards Awards

Climaxing the recent 3-day National Standardization Conference, sponsored by the American Standards Assn., was the presentation of two of industry's highest awards for standards work. One of the recipients was Senator Ralph E. Flanders, Vermont, for "great service in advancing the national economy through voluntary standards". The other award went to Col. Perry L. Houser, supervisor of manufacturing standard research for International Harvester Co., for "leadership in the development and application of voluntary standards".

Col. Houser received the 1953 Standards Medal. Sen. Flanders received the Howard Coonley Medal, established in 1950 and awarded first to the man for whom it was named, the former president and chairman of the board of Walworth Co. Other recipients have been Herbert Hoover and William L. Batt.

CRANKSHAFT GRINDING SERVICE



Established 1924 . . . 30 years experience grinding crankshafts! The most complete engine rebuilding shop in the Southwest!

ONE OF THE LARGEST CRANKSHAFT GRINDING MACHINES EVER MADE!

★ **HARD CHROMIUM PLATING SERVICE**
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Grinding Machines to handle crankshafts from the smallest up to those with a stroke of 16" and length of 200". Complete grinding service for locomotive, stationary, marine, and compressor crankshafts. Also camshaft repair and grinding service for industrial, marine and locomotive engines.

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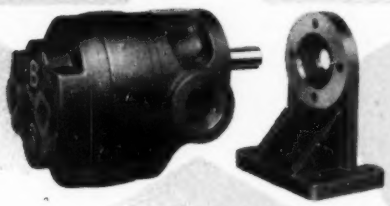
Star Performers For High Pressure



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Rotary Geared Pumps
with Herringbone Gears

These quality-built Brown & Sharpe pumps are particularly suited for diesel pressure lubricating systems up to 500 p.s.i. Needle bearing construction, combined with balanced herringbone gear design, assures smooth, dependable operation at high speeds. Leakage problems eliminated by use of double self-balancing mechanical seal . . . no glands to adjust. Six sizes available with capacities from 5.1 to 37.6 g.p.m. at 0 lbs pressure. Operating characteristics fully described in Pump Catalog. Write for copy. Brown & Sharpe Mfg. Co., Providence 1, R. I., U. S. A.

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BROWN & SHARPE B·S

BACHARACH NOZZLE TESTER for LARGE SIZE DIESEL NOZZLES

Check These Features

- Test Pump 1800 cu/mm capacity; ported design. Leak-proof—plunger is chrome steel, hardened, ground and lapped into pump body.
- Nozzle-holding Fixture has spring clamps that accommodate nozzles of different shank diameters. Nozzle is simply "snapped" into position between the clamps.
- Fuel Supply Reservoir (2.5 pint capacity) of durable, transparent plastic; fuel level can be easily observed.
- Micronic-type Filter is noted for its superior cleaning efficiency; is easily replaceable.

Get full particulars — Write for Leaflet 628

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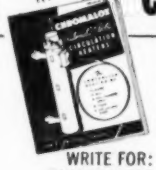
7301 PENN AVENUE • PITTSBURGH 8, PA.

SAVE MONEY & MAN-HOURS with F-A-S-T COLD-MORNING STARTS



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...It tells all about Chromalox Circulation Heaters and shows how to prewarm diesel engines, preheat fuel oils and other money saving uses.

Chromalox gives you a simple, easy way to avoid downtime and lost man-hours on cold mornings. Dependable, "packaged" Chromalox electric circulation heaters can be quickly and easily attached with flexible couplings to your engine cooling systems. Thermostatic controls provide fully automatic operation. SB-33

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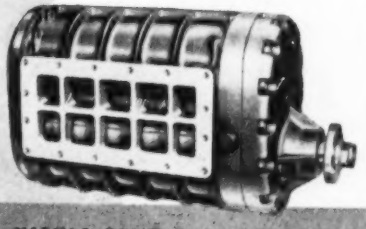
- 100-750 H.P., 15-4000 cfm., 2-15 psig.



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install it . . .
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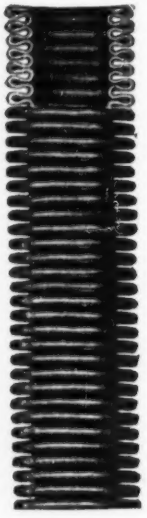
You can do that with ATLANTIC seamless diesel hose which requires no maintenance whatever.

Absolute uniformity of wall thickness . . . no seams or packed joints . . . absolutely tight against water, oil, steam, gas, air . . . dampens vibration . . . . maintains flexibility at extremely high temperatures.

Bronze, Steel, Stainless Steel, Monel — ⅛"—36" I.D. with fittings as needed.



Diesel Bulletins 1020 & 50A furnish complete information.

See our Catalogs in Sweet's Files for Product Designers and Mechanical Industries.

ATLANTIC
METAL HOSE CO., INC.
109 West 64th St.,
New York 23, N. Y.

Organizational News

Cooper-Bessemer Manager

The appointment of R. G. Williamson as branch manager of its Los Angeles district office has been announced by the Cooper-Bessemer Corp.

Mr. Williamson has undergone extensive factory-training in both engineering and operation of gas engines, diesel engines, and compressors at the company's plants. He replaces Mr. Mettling who recently resigned.

Shaler Appointment

The Shaler Co., Waupun, Wis., announces the appointment of N. T. Sauerborn to take charge of a new department for introduction of the company's multi-purpose fuel oil additive. Mr. Sauerborn has been closely associated with the industrial and marine fields in heavy residual oil developments.

Alco Elects 2 Directors

Henning W. Prentis, Jr., chairman of Armstrong Cork Co., and Col. Willard F. Rockwell, chairman of Rockwell Mfg. Co., have been elected to the board of directors of American Locomotive Co.

H. W. Prentis, Jr.

Col. Rockwell

Mr. Prentis was president of Armstrong for 16 years before he became its chairman in 1950. He is also a director of Mellon National Bank and Trust Co., the Borden Co., and the Atlantic Refining Co.

Col. Rockwell founded the company which bears his name in 1926. He is also chairman of the Rockwell Spring and Axle Co., and a director of Peoples First National Bank and Trust Co., American Mutual Liability and Insurance Co., Pittsburgh Testing Laboratory, and United Engineering and Foundry.

Consult ELLWOOD on all Your Forging Requirements

Quality Precision Crankshafts For Diesels — Since 1910 . .

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CRANKSHAFTS - CONNECTING RODS
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INJECTOR TUBE Service Tool Set

for GM Diesel Engine Models 2, 3, 4 and 6-71

SAVES TIME • SAVES LABOR
GIVES FACTORY-PRECISION RESULTS

Yes, now injector tube servicing can be done faster, more accurately than ever before . . . and with finished results that more nearly approach the original factory installation! Because, now, all the special tools required to perform the entire operation are contained in one complete, new Injector Tube Service Tool Set. Developed in cooperation with GM Diesel, the set includes nine brand new time-saving, labor-saving tools . . . and it comes conveniently boxed, as shown, with complete instructions! Order your Set now!

FREE! Kent-Moore's new 48 page Diesel Tool Guide . . . illustrating over 300 Diesel special service tools. Send for your copy today!

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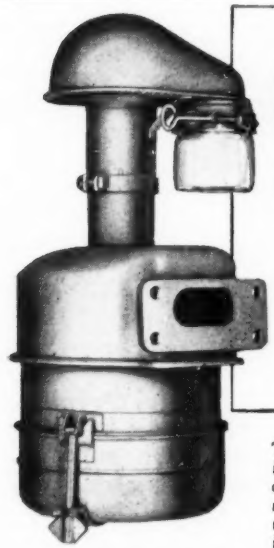
Engineers and Manufacturers of Special Service Tools and Equipment

5-105 GENERAL MOTORS BLDG. • DETROIT 2, MICHIGAN



Donaldson Air Cleaners are EASY TO SERVICE!

The simplicity and speed of servicing Donaldson Air Cleaners encourages regular attention by the machine operator. No tools are needed to remove oil cup. Cleaning cup and re-filling with oil is a two-minute job. Removable tray makes cleaning out chaff, lint, leaves and larger foreign particles simple and fast.

CUSTOM-BUILT TO FIT YOUR ENGINE

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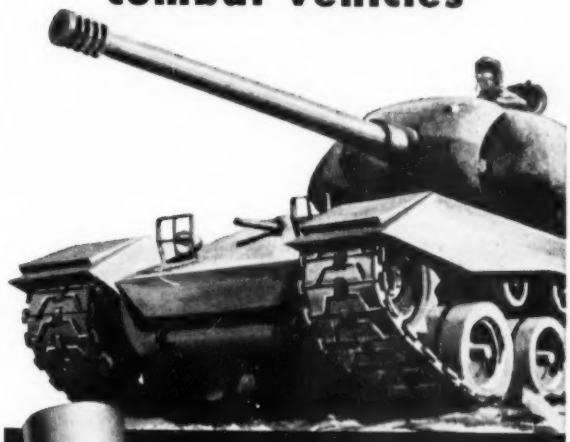
Grinnell Division: Grinnell, Iowa
Donaldson Company (Canada) Ltd., Chatham, Ontario

Donaldson *Air Cleaners Mufflers*

Dependability...

proven on ordnance combat vehicles



MAKES **DETROIT** *Vernatherm* Engine Thermostats . . .

The *BEST* Choice For Your Needs

If you're concerned with the design of lubricating oil or cooling systems for jet, heavy-duty gasoline or diesel engines it will pay you to specify DETROIT Vernatherm Engine Thermostats. For only DETROIT Engine Thermostats give you the assurance of dependable, efficient operation performance proven on military and commercial aircraft . . . on ordnance combat vehicles . . . and on most diesel makes and models. So take advantage of this outstanding record—specify DETROIT Vernatherm Engine Thermostats, the true standard of the industry for rugged, exacting service! Available as engine cooling thermostats, oil cooler thermostats, shutter thermostats and thermostatic power elements.

All DETROIT Vernatherm Engine Thermostats are . . .

- *Designed to work with either open or closed cooling systems*
- *Built with tight seats for minimum leakage*
- *Not affected by barometric pressure*
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ESTABLISHED IN 1877 AS DETROIT LUBRICATOR COMPANY

DETROIT Controls CORP.

DETROIT 8, MICHIGAN Division of American Radiator & Standard Sanitary Corporation
Canadian Representatives in Montreal, Toronto, Winnipeg: Railway & Engineering Specialties, Ltd.

AUTOMATIC CONTROLS for REFRIGERATION
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J. C. Keplinger

New Hercules President

At a recent meeting of the board of directors of Hercules Motors Corp., John C. Keplinger was elected president.

The new president first joined the corporation in 1926 as a sales manager. He became vice president in charge of sales in 1931, was elected to the board of directors in 1934, and became executive vice president in 1948.

Other new officers chosen at the board meeting were Charles Balough, who becomes the new chairman of the board of directors; Lawrence G. Downey and George W. LaSalle, who become vice presidents; F. H. Geisler, director of sales; and Dr. E. A. V. Horiak, chief engineer.

A-C Advances Manager

Promotion of Neil Pohl to the newly created position of motor grader sales manager, Tractor Div., has been announced by Allis-Chalmers Mfg. Co.

Mr. Pohl has been industrial sales manager at the Kansas City branch of the division since 1952. He had held the same position at the Winnipeg, Canada branch prior to that. Before that, he was assistant industrial sales manager at Kansas City. He had joined the company in 1948 as a member of the civil engineering section of the industrial sales department.

Bendix-Scintilla Manager

The Scintilla division of Bendix Aviation Corp. has announced the appointment of Donald B. Morse to the position of sales manager. Gerald Terpenning will succeed him as manager of sales in the West.

Mr. Morse became associated with the division in 1941 as a member of the engineering department. Mr. Terpenning, formerly a field engineer, joined Bendix in 1940.

Admiral Smiley

Rear Admiral Joins Sterling

The Sterling Engine Co. announces that Admiral Curtis S. Smiley has joined its executive staff as assistant to the president. Admiral Smiley has just retired from the U. S. Navy after 30 years of service. At the time of his retirement he was chief of staff, commander, Eastern Sea Frontier Headquarters.

Another announcement makes known the election of W. A. MacDonald as executive vice president of the company. Mr. MacDonald has been with the firm since 1951, first as sales manager and more recently as vice president, sales. He had previously served as vice president with Hupp Motors, Willys-Overland Co., and the Kaiser-Frazer Corp.

Burlington

CONTROL PACKAGE TYPE GM FOR ENGINE GENERATOR SETS

The Burlington Control Package, Type GM, housed in a rugged 14 gauge steel cabinet, contains all essential metering and voltage control for portable or stationary engine generator sets. Meters and cabinet shock mounted to minimize vibration. Installs directly on generator, eliminating need for separate switchboard.

Write for Bulletin GM-100.

- Automatic and manual voltage regulation
- Dual voltage potential transformer
- Dual ratio metering transformers
- Operating controls conveniently grouped on front of cabinet

BURLINGTON INSTRUMENT COMPANY
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DIESEL-TRUCK-BUS ENGINE CONNECTING RODS
REMANUFACTURED TO FACTORY STANDARDS

TRANSMISSION SHAFTS
And Similar Parts
HARD CHROMED AND GROUND

All Parts Magnaflux Inspected
WRITE FOR PRICES

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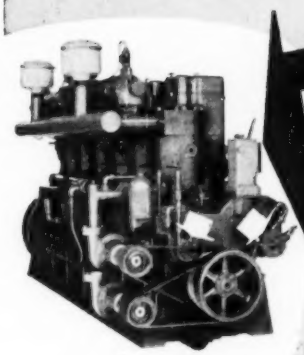
8816 Harkness Rd., Cleveland 6, Ohio
SERVING THE NATION'S LARGEST FLEETS



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It Pays to Specify

TUTHILL PUMPS

For dependable lubrication of diesel engines and power units, Tuthill offers a complete line of positive displacement pumps, designed for lubricating and scavenging. Included are automatic reversing pumps and stripped models for built-in applications.

Write for the Tuthill Pump Guide listing all Tuthill Pumps for lubricating requirements. Send specifications for quotation.

TUTHILL PUMPS FOR THE PURPOSE

TUTHILL PUMP COMPANY
Dependable Rotary Pumps since 1927
939 East 95th Street, Chicago 19, Ill.

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KIENE VALVES are designed to give good service under most severe conditions, WILL NOT BLOW OPEN, as valve opens against pressure. The KIENE VALVE HAS EFFECTIVE GAS SEAL when opened or closed, without use of packing or glands.

The KIENE VALVE is SMALL AND RUGGED, 4¼" in length and requiring only 3¼" circle of space for attachment. Has been operated at pressures up to 10,000 psi. ALL KIENE VALVES have standard indicator plug and wing nut connection. Regularly furnished with male ½" NPT engine connection. Other threads furnished on order. Special adaptions for most Diesel locomotive engines.

KIENE DIESEL ACCESSORIES, INC.
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F. Q. Wilson

Elliott District Manager

F. Q. Wilson has been appointed New York district manager of the Elliott Co. with offices at 271 Church St. Mr. Wilson, a native Californian, has been with the company since 1938 and has served as a field engineer in the Kansas City and Tulsa offices. In 1945 he was named district manager of the Tulsa office and in 1947 became district manager of the Cincinnati office.

C. Lee Cook Sales Manager

C. Lee Cook Mfg. Co. announces the election of Philip W. Mettling to the post of vice president and general sales manager. He will be located at the home office of Louisville, Ky., to which the general sales office has been moved.

Mr. Mettling brings to the organization a background of experience in the engine and compressor fields. He has been Los Angeles manager of the Cooper-Bessemer Corp. for the past 11 years, and has been active in the Pacific Coast Gas Assn. as well as a director of the California Natural Gasoline Assn.

P. W. Mettling

American Bosch Addition

Charles W. VanOverbeke has joined American Bosch Corp. as field engineer in the firm's Chicago branch office. Before this appointment, Mr. VanOverbeke held various engineering positions in the fuel injection and farm equipment fields. He also had served as instructor at Purdue University.

Pierce Governor Appointment

The appointment of Roy W. Green, formerly of the Hoof Governor Co., to its sales staff was recently announced by The Pierce Governor Co. Mr. Green has a background of 14 years with Hoof, primarily in the field of velocity-type governors. More lately he had carried primary sales engineering responsibility for a new line of centrifugal mechanical governors. In his new position at Pierce, he becomes a special assignment field man.

R. W. Green

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SAVE TIME AND MONEY BY EMPLOYING FUEL INJECTION SPECIALISTS

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E. Genn

F. D. Logan

Dollinger Assigns Reps

Earl Genn and Frederick D. Logan have been appointed district sales representatives in the Chicago area by the Dollinger Corp., according to a recent announcement.

Mr. Genn has been identified with sales engineering activities for a number of years in the Midwest. He was formerly sales engineer for the Furkert Co. Mr. Logan, prior to his association with Mr. Genn, served as a mechanical engineer for various firms. He is a member of the American Society of Mechanical Engineers.

Cuno Vice President

The board of directors of The Cuno Engineering Corp. has elected Wilfred G. Schneider to the post of vice president in charge of manufacturing. Mr. Schneider had been associated with various manufacturers of industrial products in Connecticut, prior to affiliating with Cuno in 1952. He had also served as vice president of the Middlesex Manufacturers Assn.

EMD Names Managers

The Electro-Motive Div. of General Motors has appointed J. E. Hacker to the post of manager of Plant No. 3 at Cleveland, Ohio, and R. L. Terrell to the position of works manager at LaGrange, Ill.

Mr. Hacker received his early experience with the Winton Motor Car Co. and Winton Engine Works. He joined the White Motor Co. in 1920 and left there to rejoin his early associates of Winton when he returned to the Cleveland Diesel Engine Div. of GM as works manager in 1933. He was transferred to EMD in 1948 where he served as assistant works manager and later as works manager.

J. E. Hacker

R. L. Terrell

Mr. Terrell served as an apprentice in the research laboratory of General Motors before joining EMD in 1939 as a service engineer. In 1941 he became an installation engineer on the GM pancake diesel which powered the SC boats in World War II. After the war he rejoined EMD serving as district sales manager, general parts manager, assistant regional manager, regional manager, and manager of Plant No. 3 at Cleveland.

Aeroquip Appoints Two

Aeroquip Corp. has announced the appointments of Forrest F. Hinkley to the position of director of subsidiary operations and Horace B. Ferguson to director of purchasing.

Mr. Hinkley, previously director of materials, will be responsible for coordination of sales, engineering, manufacturing, and financial functions between the company and its subsidiaries. His is a new position, created because of the continued growth of subsidiary operations. He has been a company executive for the past eight years.

Mr. Ferguson takes on Mr. Hinkley's previous post and will be responsible for procurement of materials. He joined the organization last September when he left the Free Sewing Machine Co. where he had held the position of director of purchasing.

F. F. Hinkley

H. B. Ferguson

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What Do You Know!

(Answers to Questions on Page 49)

1. Correct answer is "c". For the details and a resume of Santa Fe's dieselization program see the article appearing on Page 57.

2. Correct answer is "b". The history of pipeline operation has been one of continual expansion with practically a steady demand for maximum throughput. As a result, most engine-compressor operation is substantially continuous with high engine loading. See article on Page 46 for an example.

3. "c" is the only practical answer. "a" does little good as the exhaust ports close last. "b" produces a uniflow scavenging system. "d" cannot be done. Exhaust ports must open first (hence close last) for cylinder blowdown. For an example of "c" see article on Page 36.

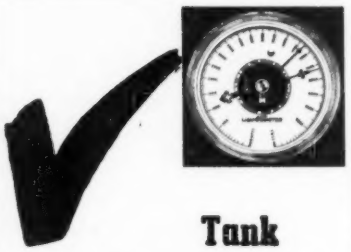
4. Correct answer is "b". This is only part of the problem. Preconditioning of fuel is equally important. For details of such a system see article mentioned above.

5. Correct answer is "b". Softness of distilled water eliminates one problem but others remain. For a discussion of water treatment problems see article on Page 64.

6. "b" and "d" do not apply to chromate-type materials. They are not compatible with the ethylene glycols and although economic in view of their excellent performance, are relatively costly when compared with, say, soluble oils. For details see article mentioned above.

7. Correct answer is "b". The tendency for pre-cleaners to break up agglomerates makes the work of the air cleaner harder. The combination, however, may have advantages as explained on Page 58.

8. Answers "c", "e" and "f", while affecting cleaner performance, do not affect air capacity. See article referred to above.



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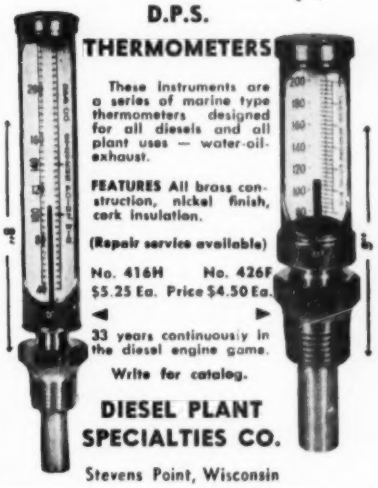

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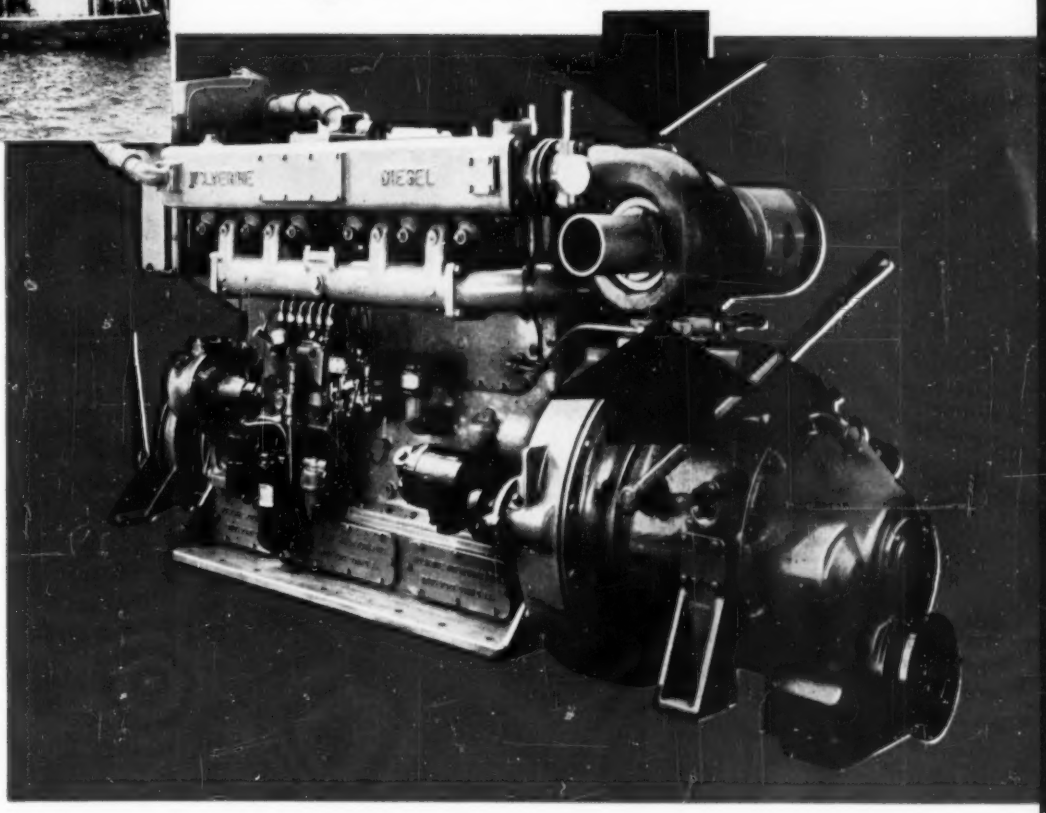

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Note the small added space required by the turbocharger on this Wolverine Engine.

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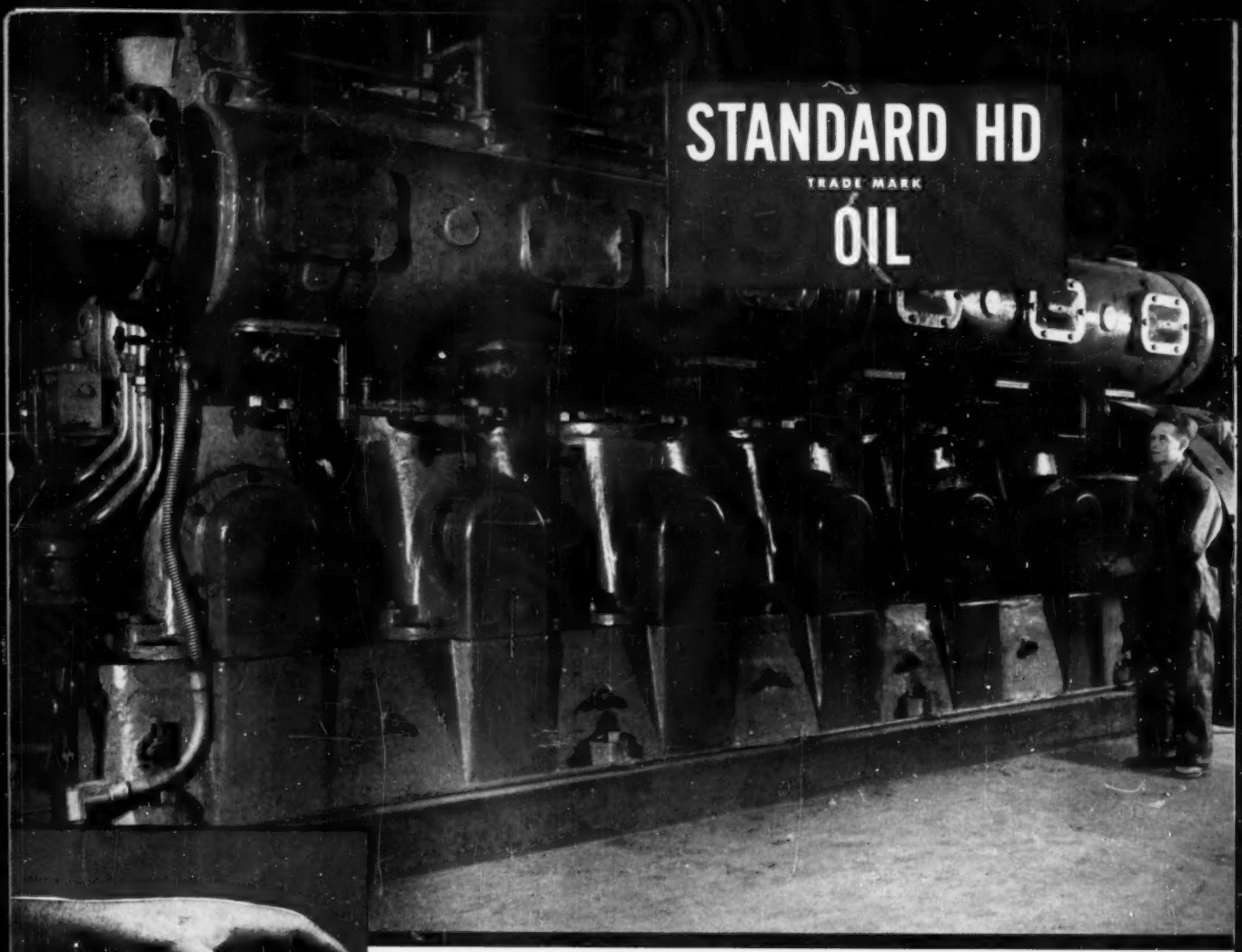

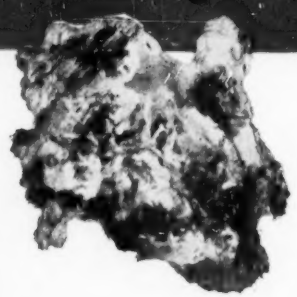

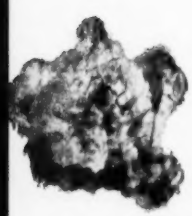

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